

A TAXONOMIC AND BIOLOGICAL STUDY OF SPECIES OF ATTAGENINI (COLEOPTERA: DERMESTIDAE) IN THE UNITED STATES AND CANADA

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ABSTRACT: The following species and subspecies within the dermestid beetle tribe Attagenini are recognized from the United States and Canada: *Attagenus cyphonoides* Reitter, *A. megatoma megatoma* (Fabricius), *A. megatoma canadensis* Casey, *A. elongatulus* Casey, *A. schaefferi hypar* new subspecies, *A. schaefferi spurcus* LeConte, *A. pello* (Linnaeus), *A. fasciatus* (Thunberg), *A. bicolor* Harold, *A. lobatus* Rosenhauer, *A. rufipennis* LeConte, *Novelsis athlophora* Beal, *N. perplexa* (Jayne), *N. varicolor* (Jayne), *N. aequalis* (Sharp), *N. uteana* Casey, *N. horni* (Jayne), *N. andersoni* Beal, *N. timia* Beal, *N. picta* Casey. Keys are provided to the adults and known larvae. Also included are diagnoses of adults, redescriptions of inadequately described adults, and descriptions of known larval forms. The species are placed in six groups according to degrees of morphological similarity, and criteria for determining the groups are discussed. It is found that during the larval stages most of the species feed on a wide variety of dried proteinaceous materials. The most common habitats for the larvae are noted as sheltered bird nests and rodent nests, but larvae may also be found in bee and wasp nests and in sheltered spider webbing. Adults commonly are observed to fly to flowers, probably to mate; however, mating may occur without flight and without feeding or drinking. The extent of depredations of stored food products and fabrics is discussed. Two species, *A. lobatus* and *A. cyphonoides*, are newly recorded as apparent recent introductions into the United States from the Old World.

INTRODUCTION

Members of the genus *Attagenus* of the family Dermestidae are well known to every entomologist as common pests of households and granaries. The name *Attagenus piceus* is probably memorized by every student enrolled in economic entomology at our American universities. Despite this familiarity, knowledge of the systematics of the New World members of the genus has seemingly regressed rather than advanced over the past seven or so decades. The last revisionary study of the American members of *Attagenus* was published in 1900 by Thomas L. Casey. This famous coleopterist was usually able to discriminate between the forms he studied, even if his species definitions cannot be accepted in the light of present knowledge. Nevertheless, his key and descriptions to the species of *Attagenus* are completely inadequate for sorting out the species. From the arrangement of the specimens in his collection, which is preserved intact at the United States National Museum, it is evident that he himself was unable to recognize the species. In several instances the specimens that stand behind a name include two or three different species. Since Casey's time, American entomologists, perhaps understandably frustrated, have quite generally designated

every more or less uniformly colored, mahogany, brown, or black specimen by the name *Attagenus piceus*. This practice has been followed without regard for some obvious morphological differences and in spite of the well-documented fact that the specific trivial name *piceus* is not applicable to any of the forms in question.

The problem of defining the limits of the genus has not been of concern to American students, since our Attagenini appear to fall very neatly into two groups, and the number of species is not large. H. F. Jayne, who revised the Dermestidae in 1882, placed members of both groups in *Attagenus*. Casey, however, separated the groups and erected the genus *Novelsis* to accommodate one of them. This separation has been a convenience, but, unfortunately, when members of the group from other zoogeographical areas are considered, the classification proves inadequate. Several European workers have arranged many members of *Attagenus* under the subgenera *Telopes* Redtenbacher (1843) and *Lanorus* Mulsant and Rey (1867). Both these names have priority over *Novelsis*, and probably a number of our American species should be assigned to them. The difficulty lies in knowing exactly what these subgeneric names represent. The greatest number of characters available for a generic classification seem to be found in the larvae; however, the larvae of the type species of *Lanorus* and *Telopes* have not been available for study. A fairly adequate classification might be worked out for the species of Attagenini, but until the type species of these genera have been investigated, the status of any generic names that are used will necessarily remain in doubt. In view of this uncertainty, I am not attempting in this paper to rename any of the generic groups within the Attagenini or to reassign any of the species to other genera. Current generic names are used throughout the paper, even though they do not correctly represent the natural groups within the Attagenini. A possible arrangement of the species into natural groups is proposed, but a determination of the names to be applied to the groups should await a more cosmopolitan study.

An alternative solution to the problem of reassigning the species of Attagenini to a number of different genera is to lump them all under *Attagenus*, as has been done by several European workers. Although this would be a convenience to cataloguers, it would also serve to delay growth in knowledge of the group. There are approximately 160 species of the tribe scattered throughout all the zoogeographic regions of the world. It is scarcely conceivable that these species do not fall into a number of smaller, definable groups.

The discovery of these groups will provide a framework around which biologists other than systematists can organize their data. Comparison of these data may in turn assist the systematist to confirm or to refine his classification. A reasonable degree of subdividing would better serve the needs of both the functional biologist and the systematist. Therefore, it seems uneconomical at present to reassign the species of *Novelsis* to *Attagenus*. Very possibly and hopefully in a short time most of the species will be given other generic assignments.

The primary purpose of this paper therefore is to define the Nearctic species of the tribe. A diagnosis of each species is given, together with a redescription of the adult when necessary and a description of the mature larva whenever possible. All available biological information that bears upon the definition of the species is also included. Keys for the identification of adults and known larval forms are provided to make the definitions more useful.

A second purpose of the paper is to present the biological data available for each species. Extensive data have been collected in the past for a few of the species. Unfortunately, in many instances the specimens studied were not deposited in a museum and there is no way of knowing their actual identity. Where there has been access to the specimens from which the data have been gathered, the information is related in the paper to the correct name of the species. Otherwise the data are ignored.

METHODS OF PREPARING LARVAE

The difficulty of using microscopic characters for studying and identifying the larvae is further aggravated by the fact that there seems to be no rapid way to prepare a slide mount of a specimen and leave all the useful characters visible. Most of the specimens used in this study were cleared in KOH, dehydrated in glacial acetic acid, cleared in beachwood creosote, and mounted in a balsam substitute. While the specimen was in the creosote the mouthparts were dissected out and the body cut open the entire length along the median suture. The body was then mounted spread out with the inside surfaces of the integument against the slide. Mouthparts were mounted on the same slide under separate 6 mm. coverslips. Some of the specimens studied were cut open the same way but mounted directly in Hoyer's medium. Although this method allows for rapid preparation, the terga tend to retain their curved shape, so that even if the specimen is generally well-flattened the edges

of the terga are usually bent under and the spiracles difficult to observe. Clearing in KOH seems to make the terga easier to flatten, leaving the spiracles and their associated sclerites flat against the slide. It was found that specimens of most species can be identified quickly by using iridectomy scissors to cut out a piece of an abdominal segment with the spiracle, a part of the tergum, and a part of the sternum included. This piece is then mounted on a slide in Hoyer's medium. Often the setae covering the spiracle need to be teased away first. However, to use the key, the entire specimen needs to be mounted.

CHARACTERS AND TERMS

SELECTION OF GENERIC CHARACTERS: The difficulty that arises when one attempts to split the tribe Attagenini into genera is that if one set of characters is used to segregate the genera, the groups are ordered differently than if another set of characters is used. There are a number of sets that might be used, and there are as many conceivably different ways of ordering the genera. This kind of problem is a familiar one in the animal kingdom. The taxonomist must apparently make an *a priori* decision that certain characters are of generic value and group the species accordingly. Some criterion such as "adaptive significance" or "phylogenetic stability" might be used to select the generic characters. However, if it were to be granted that one or another of these criteria had taxonomic significance, it would be of little use at this time in choosing characters for genera of the Attagenini. Not enough is known of the adaptive value of the characters present in the larval or adult stages or of the phylogeny of the group to make such judgments. Fortunately, there is a rational way out of the dilemma. The taxonomist can first determine the genera and afterward find generic characters to match. It is not necessary to have generic characters prior to dividing a larger taxon into its genera. A "natural" classification can be achieved if the species are first grouped on the basis of their over-all similarities and dissimilarities. This is exactly what the classical taxonomist did with his "eye." However, there are so many characters present among the species of Attagenini when both adult and larval stages are considered, the taxonomist cannot trust his mere impressions. It is necessary to tabulate and count the differences. Once this has been done, there is an objective basis for grouping the species. The species within each group are more likely to share a greater number of genetic similarities than with any species

of a different group. After the discovery of the groups, the generic characters are relatively easy to find. At least with the use of this procedure in the Attagenini the generic characters have not been difficult to identify. They are those characters that are common to all members of the group. No judgment is made as to their adaptive or phyletic value; no judgment is necessary. So far as their use in classification is concerned, they become the "key" characters by which the genera are recognized.

This is the procedure that has been followed in sorting the species of Attagenini into groups in the pages following. Those characters that are common to all members of a group are termed "generic," even though for the present no nomenclatural assignments to genera are made.

ADULT CHARACTERS: Previous workers have usually considered the relative sizes of the segments of the male antennal club of generic significance. Casey placed in *Attagenus* those species with the first two segments of the club extremely short in comparison with the third segment and in *Novelsis* those species with the first two segments elongated. However, if both adult and larval characters are tabulated and the species grouped as described above, the relative lengths of the segments of the club are seen to be of a low order of importance. On the other hand, a useful generic character is found in the shapes of the metacoxa and the metepimeron. In some species the ventral lamina of the coxa extends laterally to meet the metepimeron, which is somewhat curved behind the metepisternum, thus enclosing the metepisternum behind. In other species these do not meet behind the metepisternum, so that the metepisternum appears open behind. Each of these conditions is correlated with other characters common to the groups and accordingly is a useful generic character. The relative sparseness or density of the body setae and also the length of the setae on the antennal club are similarly correlated with other characters and are useful in recognizing the species groups. Most of the other adult characters used in the key are of significance at the species level only, including the number of segments in the antenna, the convexity or concavity of the hypomeron, and patterns in the elytral pubescence.

If there are significant differences in the genitalia, I have been unable to discover them. There are minor genitalic differences between some of the species, but none of such a nature that they would be of value in sorting the species into groups. Neither have I been able to find significant differences in the wing venation.

The length of the terminal segment of the male antenna is to some extent correlated with the combined length of the pronotum and elytra and a useful character for distinguishing between some of the species. A high correlation exists between the length of the terminal antennal segment and the length of the elytron alone, at least in the *megatoma* section (Group I in this paper). However, a regression line drawn for a number of measurements plotted on a graph passes relatively far to one side of the zero point. As a result, the correlation is difficult to use as well as to express. The regression line for correlations between the last antennal segment and the total length of the pronotum and elytron passes somewhat closer to the zero point. Accordingly, it is easier to use and has been used in the descriptions following, even if at some sacrifice of precision.

Many authors have described or figured the male antennal club as an aid in distinguishing the species, assuming that the relative lengths of the first two segments are closely correlated with the length of the terminal segment. However, there is no more than a moderately low correlation between these measurements. Although the ratio is of value in separating some groups of species, it is of little worth in distinguishing between "close" species, such as *A. elongatulus* and *A. megatoma*. Relatively poor correlations are found between the interocular width and the length of the terminal antennal segment or between the interocular width and the combined length of the pronotum and elytra.

LARVAL CHARACTERS: A number of characters useful both for distinguishing between the species and for grouping them into natural assemblages are found in the larvae. Unfortunately, most of the characters are so minute they cannot be easily observed except through a compound microscope. The body setae are usually longitudinally ribbed. They may be broad and flat with numerous ribs or they may be linear and more or less round in cross section with many or few ribs. The number of such ribs is often significant. Most of the setae are recumbent, but near the posterior margin of each tergum is a row of erect setae. Close to the margin of the socket of each of these erect setae is one or two pits, each roughly a fourth the diameter of the socket and presumably sensory in function. Whether there is one or two pits beside each socket and, if there is a single pit, whether it is on the medial or lateral side of the socket appear to be useful characters.

Since it is necessary to describe differences between setae inserted on different areas of the abdominal segments, the meaning of the following terms should be noted. By *tergum* is meant the entire

dorsal sclerotized area of each abdominal segment. Near the anterior margin of each tergum, except the ninth and occasionally the eighth, there is a transverse suture, the *antecostal suture*. That part of the tergum anterior to the suture is designated the *acrotergite*. The term *tergite* is used for the sclerotized part of the tergum posterior to the suture.

The shape and position of the spiracle and the nature of various structures associated with it are significant. The spiracle may be a simple, somewhat circular opening on the posterior margin of the tergum (Fig. 12) or it may be a narrow slit with thickened margins some distance in front of the posterior margin of the tergum (Fig. 11). Close to the spiracle at the lateral margin of the tergum is a small sclerite bearing several long setae. This structure is termed the spiracular sclerite in the key and descriptions that follow. The spiracle may be adjacent to the sclerite or may open a distance from it. If at a distance, there is a narrow suture-like slit between the sclerite and the spiracle. The sclerite may be almost completely enclosed by the tergum or may appear to be almost entirely free of the tergum. In the latter case there is a narrow sclerotized margin of the tergum along the anterior edge of the spiracular sclerite, but the part of the tergum in front of this margin is membranous, so that the margin appears at first glance to be part of the sclerite.

For many of the species only a limited number of larvae were available for study. As a result, I am not certain whether some of the observed differences are valid species characters or whether they are merely differences that vary within the species. Possibly there are a number of "good" characters associated with the shape and setation of the femora and tibiae. However, there is considerable variation in the pattern of setation in the species for which long series were available. Consequently, it has been difficult to make reliable comparisons with species for which only one or two specimens were at hand. Apparently there are also some secondary sexual differences in the shape of the larval tibia in some of the species. The sex was not known for many of the larval specimens studied, so the status of these characters has had to remain undefined. I have illustrated the protibiae of three species where the differences are quite marked and have noted some apparent differences in the descriptions of other species. However, I have made no use of these characters in the key or in grouping the species. The number of setae observed on the labial palps is described, but may be of little significance. The shapes of the glabrous areas on the pronotum

appear to differ from species to species, but the differences are not pronounced and are difficult to utilize.

The length of each antennal segment in relation to the lengths of the other antennal segments as well as the length of the antennal setae in relation to the lengths of the antennal segments provide useful characters for distinguishing between species in other tribes of dermestids. Little correlation was found between these measurements in these species. One character that appears to be of moderate value in distinguishing a few of the species is the length of the long seta at the apex of the third antennal segment in comparison with the length of the segment. Unfortunately, the seta is easily broken off in preparing a slide mount and is available for use with an occasional specimen only.

CHARACTERS FOR RECOGNITION OF THE ATTAGENINI

A single character that distinguishes adult members of the Attagenini from those of other tribes of Dermestidae is the short first segment of the tarsus of the hind leg. This segment is not more than half as long as the second segment. The following combination of characters will also serve to identify members of the tribe. The body is covered with subrecumbent to suberect hairs, never with scales. The head bears a distinct median ocellus. The pronotum does not have a distinct sublateral carina on each side. The hind wings are well developed. The antennal club is 3-segmented, with the segments moderately enlarged and in the male sometimes greatly elongate. The hypomeron may be broadly and deeply concave to slightly convex but, if concave, not forming a distinct cavity for the antenna and not margined behind. The prosternal process is long and narrow and is received in a shallow groove in the mesosternum. This groove becomes more shallow posteriad, so that the mesosternum is not completely divided and its hind margin is visible for its entire width. The abdomen has five free and externally visible sternites.

The larvae of the Attagenini are readily recognized by their shape, the body being elongate, gradually tapering posteriad from the metathorax, rounded dorsally, and flattened ventrally. The terminal segment is provided with a brush of long, slender setae. Setae of the body may be scale-like or long and slender with minute imbricate scales (spicisetae), but are never spear-headed (hastisetae), clavate, basket-shaped, or branched. The antenna consists of two

moderately long basal segments and a shorter terminal segment. The maxillary palp is 4-segmented, the first two segments being short, the third long and curved inward, and the fourth long but shorter than the third. Each notum and tergum, except the tergum of the ninth abdominal segment, includes at its lateroposterior angle a spiracular sclerite, which bears several long, slender setae. The ninth abdominal segment lacks urogomphi. The tenth segment is apparently unrepresented by any sclerotized parts, unless the small paired sclerites inserted in the sternum of the ninth segment represent part of the tenth. Additional descriptive details are given by Rees (1943).

RELATIONSHIPS

With the use of the procedures described for sorting species into groups, our American *Attagenini* fall into the following six groups.

- Group I. *Attagenus cyphonoides*
Attagenus megatoma
Attagenus elongatulus
Attagenus schaefferi
Attagenus pellio
Attagenus fasciatus

The larvae of each of these species are characterized by having setae with smooth rather than serrulate or denticulate margins, spiracles that open a short distance in front of the posterior margin of the tergum rather than on the margin, and spiracular sclerites that are bounded anteriorly, medially, and usually laterally by the tergum, but not posteriorly. The tergum is entirely sclerotized in front of the spiracular sclerite. Characters common to the adults include the approximation of the metacoxa and the metepimeron, extremely short and fine setae on the male antennal club, and moderately short and dense, subrecumbent body setae. All except *A. fasciatus* have a male antennal club in which the first two segments combined are much shorter than the last segment. *A. fasciatus* could justifiably be placed in a group by itself: the adults differ noticeably in having much stouter legs and an absence of secondary sexual differences in the form of the antenna. The decision to include *A. fasciatus* here is more or less arbitrary. It is meant to show that in total characters it is closer to this group than to any of the following.

The type species of *Attagenus* is *Dermestes pellio* Linnaeus,

according to Hope (1840). Therefore, Group I would carry the name *Attagenus*, should the other groups be assigned generic names.

Group II. *Attagenus bicolor*

Novelsis athlophora

In general fascies, adults of *A. bicolor* are similar to members of Group I. They differ in the structure of the hypomeron, which does not enclose the base of the procoxa but leaves the base and the trochantin fully exposed. Species of each of the other groups have an auricular-like structure enclosing the trochantin and the base of the procoxa behind (except that it is somewhat reduced in *N. horni* of Group VI). Adults also possess long, sparse, usually wholly black body setae. The setae may be dark brown in immature specimens but otherwise are uniformly black. The larvae differ from members of Group I in many respects. The margins of the setae are micro-serrulate, a character shared with the groups that follow. The spiracular sclerite is completely enclosed behind by a broad area of the tergum. The spiracle, though associated with the spiracular sclerite by a narrow channel, is some distance from it and some distance from the posterior margin of the tergum. The setae on the pretarsus of *A. bicolor* are subequal in width and length, as they are in Group I, whereas the species in the groups following have one of the two setae twice as wide as the other. However, the setae in *A. bicolor* are four-fifths the length of the claw, whereas the setae in members of Group I are not over half the length of the claw. *N. athlophora* is tentatively included in Group II in view of its similarity in adult characters to *A. bicolor*. A further discussion of the similarities will be found in the section on *A. bicolor*.

Group III. *Attagenus lobatus*

This species seems quite obviously to belong to no other group of Nearctic species, although it has more characters in common with Group I than with any other group. The larvae are unique in having ten or more setae inserted in each spiracular sclerite and in having a row of long, stout, linear setae near the anterior margin of each abdominal sternum. Another remarkable larval character is found in the extremely long and fine setae inserted on the acrotergites. *N. uteana* of Group IV also has such long and fine setae on the acrotergites but, unlike *A. lobatus*, it also has a row of ensiform setae on the acrotergites. Unique characters in the adult include the fine, thread-like carina on the dorsal margin of the

anterior tibiae, the exceptionally fine dorsal pubescence, and the elongation of the basal lobe of the pronotum.

Group IV. *Novelsis varicolor*

Novelsis perplexa

Novelsis aequalis

Larval stages of *N. perplexa* are unknown, but it can be presumed on the basis of adult similarities that the species belongs in the same group as *N. varicolor* and *N. aequalis*. Although the latter two species differ in a number of larval characters, they share more characters with each other than with any other species. The most noticeable characters aligning them with each other are associated with the body setae. These are broadly oval and strongly ribbed, with serrulate or denticulate margins and ribs. In addition, the spiracular sclerite is enclosed by the tergum, although the tergum is not sclerotized in front of the sclerite in *N. aequalis*. Two distal sensory pits are present on the epipharynx, but are very minute. Adults of all three species are remarkably similar in the structure of the antennal club, the erect setae of the male antennal club, the dense, suberect setae of the dorsum, and the type of pattern formed by the tricolorous elytral setae.

Attagenus varicolor Jayne is the type species of the subgenus *Paranovelsis* Casey by monotypy. Should the members of Group IV not be found congeneric with one of the Palearctic genera, they should be arranged under this name. However, adults of the type species of *Lanorus*, *Dermestes vigintiguttatus* Fabricius = *Attagenus punctatus* (Scopoli), resemble members of this group in a number of respects. Without a study of the larvae of *A. punctatus* it would be hazardous to affirm the distinctiveness of our Nearctic species.

Group V. *Attagenus rufipennis*

Adults of this species superficially look very much like members of Group I, particularly in the shape of the male antennal club, which has the terminal segment many times longer than the two very short preceding segments. However, the separation of the coxal plate from the metepimeron is a character distinguishing the species from the members of Group I and suggesting some other fundamental differences. Numerous differences are found in the larvae, which are more like larvae of Group VI than those of any of the foregoing groups. They differ from members of Group VI in possessing a distal series of two small sensory pits on the epipharynx, two rather than one sensory pit adjacent to the sockets of the sub-

marginal erect setae of the terga, and two small sclerites in the sternum of the ninth abdominal segment.

Group VI. *Novelsis uteana*
Novelsis horni
Novelsis andersoni
Novelsis timia
Novelsis picta

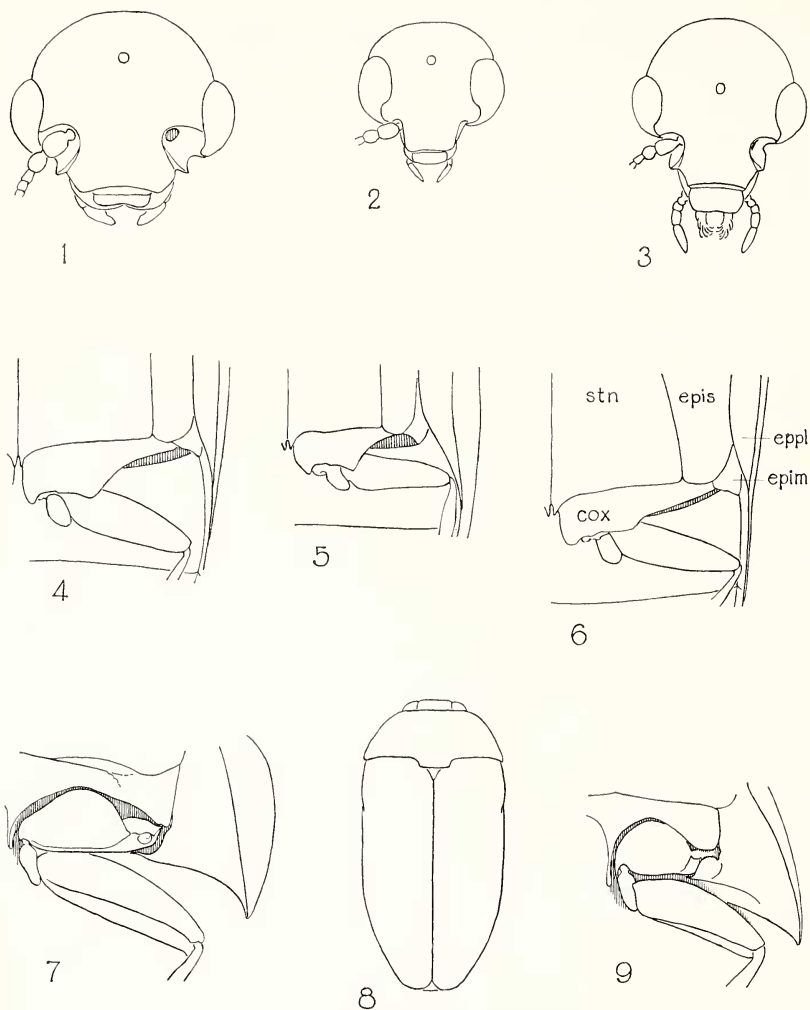
Unique characters among larvae of this group include the following: the lack of paired sclerites in the sternum of the ninth abdominal segment, the lack of a distal series of sensory pits on the epipharynx, no more than three setae on the dorsal side of each lobe of the ligula, and only one sensory pit adjacent to each socket of the submarginal erect setae of the terga. With reference to the last character, members of all other groups have two or occasionally three sensory pits adjacent to each socket, except that *A. bicolor* has some sockets with one and some with two adjacent sensory pits. Members of Group VI along with *A. rufipennis* (Group IV) have the tergum in front of the spiracular sclerite unsclerotized, so that the sclerite appears to project laterad somewhat peninsula-like. Larvae of *N. timia* and *N. picta* are unknown, but these species are included in the group because of adult similarities. The adults share a number of characters not found in other North American Attagenini. The front coxae are elongated relative to the length of the prosternal process, so that the coxae extend posteriad beyond the apex of the process. The epipleuron opposite the middle of the metepisternum lies in nearly the same plane as the incurved side of the elytron, instead of forming an angle with it of 90 to 120 degrees. The segments of the male antennal club are greatly elongated, so that the antenna in repose extends beyond the anterior margin of the metepisternum.

Attagenus horni Jayne is the type species of *Novelsis* (designated by Beal, 1954).

KEY TO THE NEARCTIC SPECIES OF ATTAGENINI

ADULT

1. Dorsal setae unicolorous, black or blackish brown; setae on disc of pronotum and elytra as long as combined length of antennal segments 3, 4, and 5, or longer. Setal punctures on disc of pronotum and base of elytra separated by two and usually three to four or more times diameter of single



FIGS. 1-9: Fig. 1. Head of adult of *Attagenus bicolor*. Fig. 2. Head of adult of *A. lobatus*. Fig. 3. Head of adult of *A. megatoma*. Fig. 4. Left metasternal coxa and associated sclerites of *A. elongatulus*. Fig. 5. Left metasternal coxa and associated sclerites of *Novelsis varicolor*. Fig. 6. Left metasternal coxa and associated sclerites of *A. bicolor* (stn = sternum, epis = episternum, eppl = epipleuron, epim = epimeron, cox = coxa). Fig. 7. Left prosternal coxa and associated sclerites of *A. bicolor*. Fig. 8. Outline of dorsum of *A. lobatus*. Fig. 9. Left prosternal coxa and associated sclerites of *A. megatoma*.

puncture. Hypomeron not forming lobe behind base of procoxa; base of procoxa and trochantin exposed (Fig. 7). 2

Dorsal setae unicolorous, bicolorous or tricolorous; setae on disc of pronotum and elytra seldom longer than combined length of antennal segments 3 and 4, usually shorter, although setae on margins of elytra and pronotum may be longer, but if dorsal setae longer than length of antennal segments 3, 4, and 5 combined, then setae bicolorous or tricolorous. Setal punctures of disc of pronotum and base of elytra hidden by dense pubescence or, if visible, usually separated by one or two times diameter of single puncture. Hypomeron forming auricle-like lobe behind base of procoxa so that base of procoxa and trochantin largely hidden (Fig. 9). 3

2. Antenna 11-segmented; male antenna with terminal segment of club five times as long as length of two preceding segments combined. *Attagenus bicolor*

Antenna 10-segmented; male antenna with terminal segment no more than four-fifths as long as length of two preceding segments combined. *Novelsis athlophora*

3. Elytron with black hairs except for prominent oval spot (about as broad as eye) of white hairs at middle of disc near suture and often also with two or three very small lateral white spots at about basal two-fifths. *Attagenus pello*

Elytral pubescence unicolorous or with bands of light pubescence or with several large spots of light pubescence, but not as described above. 4

4. Lamina of hind coxa not meeting metepimeron; coxa and epimeron appearing separated by metepisternum (Fig. 5). 5

Lamina of hind coxa extending behind metepisternum to meet metepimeron (Fig. 4). 15

5. Antenna 10-segmented. 6

Antenna 11-segmented. 9

6. Dorsal pubescence tricolorous: black, golden-brown, and white; ventral pubescence light golden-yellow; setae on margin of fifth abdominal sternum dark brown or black. Male antennal club clothed with erect hairs about three-fourths as long as width of third antennal segment. *Novelsis perplexus*

Dorsal pubescence unicolorous or bicolorous; ventral pubes-

cence whitish, including setae on margin of fifth abdominal sternum. Male antennal club clothed with closely appressed hairs not longer than one-fourth width of third antennal segment. ----- 7

7. Elytral integument brownish black to black with contrasting light tan or reddish yellow maculae; maculae forming oblique subbasal band, sutural line from base to apex or near apex, and marginal line from base or near base to apical fourth; whitish pubescence limited almost entirely to light-maculate areas. ----- Female of *Novelsis andersoni*

Integument brownish black without maculae or maculae, if present, more or less diffuse and difficult to see because of dense pubescence; setae on elytron unicolorous, whitish, or brown and whitish; if bicolorous then white setae forming two irregular bands on apical half or several longitudinal lines on apical half or white setae interspersed among dark setae on apical half. ----- 8

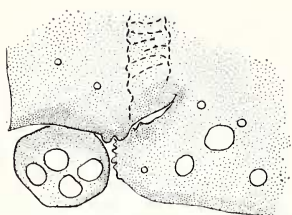
8. Hind tibia bearing on posterior side numerous erect setae more than three times as long as spines along shaft of tibia. Elytron with whitish setae forming irregular circle on basal half and two bands on posterior half. Male antenna in repose extending almost to hind margin of metepisternum.

----- *Novelsis picta*
Hind tibia without long, erect setae but with usual long, recumbent setae through which project short, stout spines. Elytron entirely covered with whitish hairs (females) or with dark hairs among which whitish hairs form basal band, subbasal oblique band, sutural line, and several somewhat distinct lateral lines on apical half (males and occasional females). Male antenna in repose extending about as far as hind margin of middle coxa. ----- *Novelsis uteana*

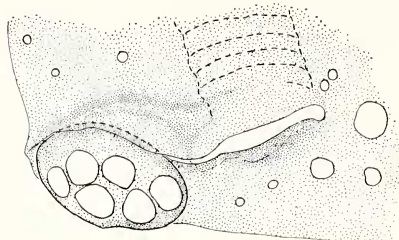
9. Pronotum with middle basal part prolonged backward to form broad, apically truncate lobe (Fig. 8). Anterior tibia with sharp, knife-like carina along dorsal margin; short, stout spines inserted in row along posterior side of carina and on posterior face of tibia but not on anterior face of tibia.

----- *Attagenus lobatus*
Pronotum produced only feebly backwards at middle basal part. Anterior tibia rounded on dorsal margin without knife-like carina; short, stout spines inserted irregularly along dorsal margin as well as on posterior face, with or without spines on anterior face of tibia. ----- 10

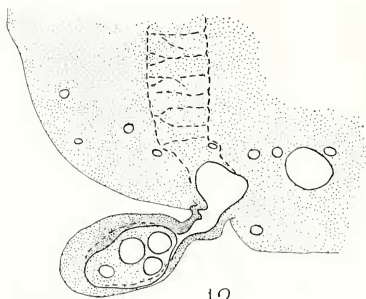
10. Male antennal club with terminal segment at least four times as long as length of two preceding segments combined; female antennal club with terminal segment one-eighth longer than length of two preceding segments combined. Integument of elytron colored black, mahogany, or mahogany with base black and with black sutural line; elytral setae entirely black or black with sparsely intermingled golden-yellow hairs or black with band of golden-yellow hairs at basal fourth. ----- *Attagenus rufipennis*
Male and female antennal club with terminal segment equal in length or shorter than length of two preceding segments combined. Integument of elytron colored black, reddish yellow, or light brown with or without clearly defined maculae, but if black with suffused mahogany area on disc, then bands or patches of whitish pubescence present on apical as well as on basal area of elytron. ----- 11
11. Hypomeron (ventrally inflexed side of pronotum) deeply concave, forming fossa for antenna. Male antennal club clothed with erect, white setae about three-fourths as long as width of third antennal segment. Pubescence of elytron consisting of black hairs and light colored hairs; light colored hairs forming thin band at base, semicircular subbasal band, irregular submedian band, and irregular subapical band. ----- 12
- Hypomeron flat or slightly convex. Male antennal club clothed with closely appressed setae about as long as one-fourth width of third antennal segment. Pubescence of elytron various. ----- 13
12. Elytral integument with poorly defined brown or reddish brown area on basal two-thirds and occasionally with reddish subapical spot. Plane of disc of prosternum and plane of lateral lobe of prosternum separated by step-like bend in prosternum. ----- *Novelsis aequalis*
Elytron with more or less sharply-defined reddish yellow or light tan macula occupying most of disc of elytron or with two or three distinct subbasal, median, and subapical maculae. Declivity in prosternum forming transition between plane of disc of prosternum and plane of lateral lobe. ----- *Novelsis varicolor*
13. Elytral integument reddish yellow to brown, immaculate. Light-colored pubescence of elytron forming broad band at basal



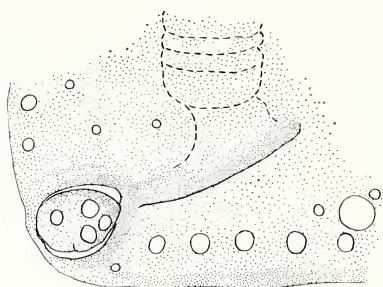
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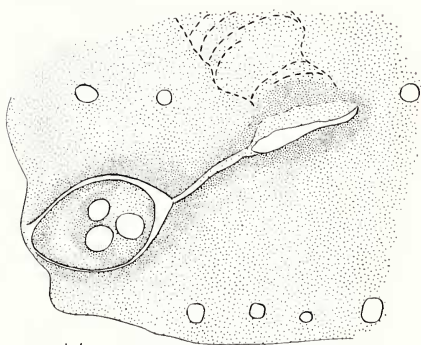
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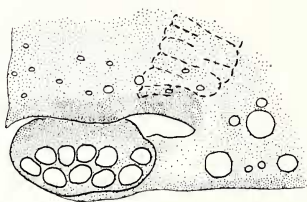
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14



15

FIGS. 10-15: Spiracles and spiracular sclerites from first abdominal tergum of mature larvae of Attagenini. Sockets where setae are inserted are shown as circles, although the setae are not shown. In general the size of the seta is proportionate to the size of the socket. Fig. 10. *Attagenus cyphonoides*. Fig. 11. *A. megatoma*. Fig. 12. *A. rufipennis* (form from Santa Barbara, California). Fig. 13. *Novelsis varicolor*. Fig. 14. *A. bicolor*. Fig. 15. *A. lobatus*.

fourth, submedian band, and subapical band; submedian and subapical bands connected by sutural line of light pubescence. ----- *Novelsis timia*

Elytral integument dark brown to black with contrasting light tan or reddish yellow maculae; light maculate areas forming oblique subbasal band and sutural line from base to apex or near apex; light line along lateral margin present or absent. Light-colored pubescence mostly limited to light maculate areas of elytron; no light pubescence present behind middle of elytron except on light maculate sutural and marginal lines. ----- 14

14. Marginal line of light maculation present on elytron and extending from base to posterior third or fourth. -----

----- Male of *Novelsis andersoni*

Marginal line of light maculation usually appearing as short spur on oblique subbasal band, but at most extending from base no further than middle of elytron. ----- *Novelsis horni*

15. Elytron covered with dark hairs except for very well-defined, subbasal band of light pubescence; band usually broad and extending continuously to median suture but occasionally reduced to two light-colored narrow bands on middle of elytron at basal two-fifths and spot of light-colored hairs on median suture at basal fourth. ----- *Attagenus fasciatus*

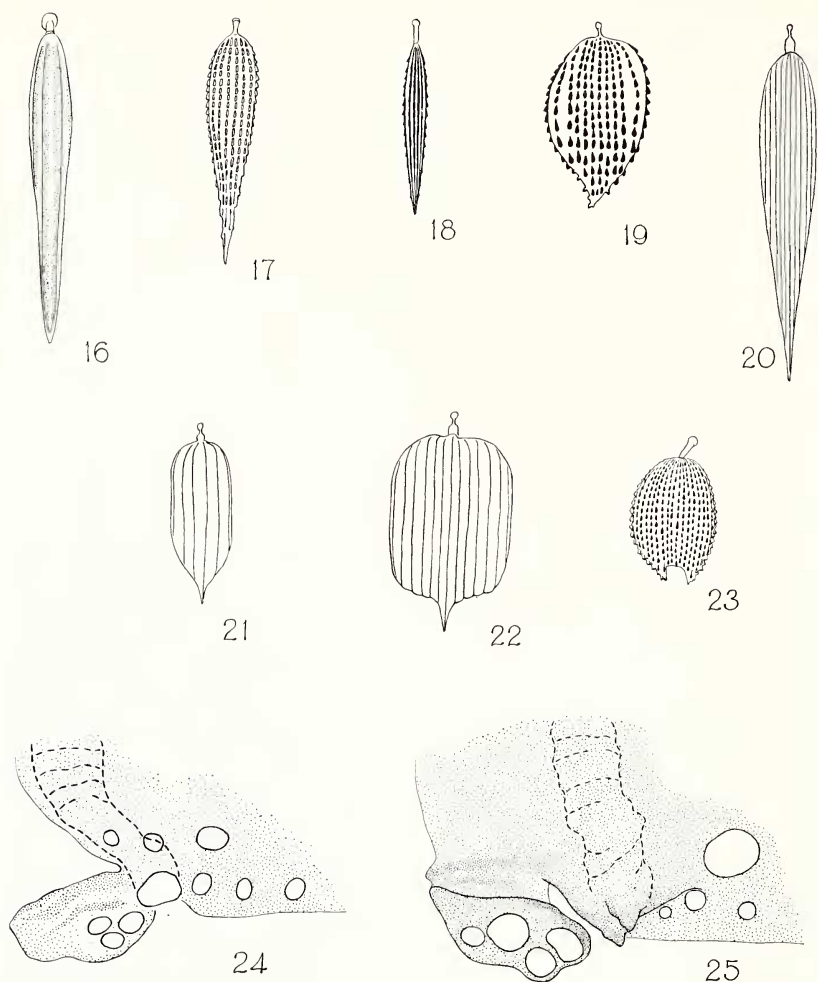
Elytron unicolorous or with diffuse subbasal or basal band of light-colored hairs; subbasal band, if present, not extending to median suture and no subbasal patch of light-colored hairs present on suture. ----- 16

16. Antenna 10-segmented. Ultimate segment of antennal club more than 6.0 times as long as length of two previous segments combined. ----- *Attagenus schaefferi*

Antenna 11-segmented. Ultimate segment of male antennal club less than 5.8 times as long as two previous segments of club combined. ----- 17

17. Posterior margin of lateral lobe of prosternum bent almost vertically in front of coxa. Posterior ventral carina of middle femur much weaker than anterior ventral carina and on apical half of femur two-thirds as far from dorsal margin as anterior ventral carina. Elytral integument and hairs medium to dark brown with few light golden hairs forming indistinct lateral fascia at about basal fourth. -----

----- *Attagenus cyphonoides*



FIGS. 16-25: Fig. 16. Seta from disc of first abdominal tergite of *Attagenus megatoma*. Fig. 17. Seta from second abdominal acrotergite of *Novelsis varicolor*. Fig. 18. Seta from disc of first abdominal tergite of *A. rufipennis*. Fig. 19. Seta from disc of first abdominal tergite of *N. varicolor*. Fig. 20. Lanceolate seta from eighth abdominal tergite of *A. pellio*. Fig. 22. Scale-like seta from disc of eighth abdominal tergite of *A. pellio*. Fig. 23. Apically bifurcated scale-like seta from first abdominal tergite of *N. aequalis*. Fig. 24. Spiracle and spiracular sclerite of sixth abdominal tergum of mature larva of *N. aequalis*. Fig. 25. Spiracle and spiracular sclerite of seventh abdominal tergum of *A. pellio*.

Posterior margin of lateral lobe of prosternum weakly reflected against base of procoxa with reflected portion extending ventrad at about thirty to forty degree angle. Posterior ventral carina of middle femur about as distinct as anterior ventral carina and almost in same plane. Elytral pubescence piceous to black; light-colored hairs, if present, forming fascia at base of elytron or limited to extreme lateral margin of elytron; integument of elytron mahogany to black. 18

18. Ratio of length of terminal segment of antenna of male to length of pronotum and elytra combined varying from 1:5.7 to 1:7.6. Pronotum with band of golden hairs along basal margin; greatest length of band (measured anteriorly to posteriorly) about equal to length of scutellum. Elytron with golden hairs absent or limited to scattered hairs or small patches of hair along basal margin and not extending posteriad beyond apex of scutellum except along extreme lateral margin. *Attagenus elongatulus*

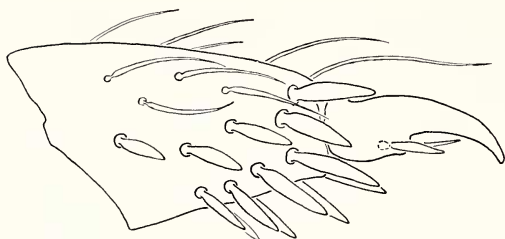
Ratio of length of terminal segment of antenna of male to length of pronotum and elytra combined varying from 1:7.9 to 1:11.4. Pronotum without band of golden hairs along basal margin, or band present and not longer than half length of scutellum, or latero-posterior angles and basal margin covered with golden hairs. Elytron without golden hairs or varying number of golden hairs present on basal fourth; if golden hairs present on base of elytron, these commonly extending from base well beyond scutellum. *Attagenus megatoma*

KNOWN MATURE LARVAE

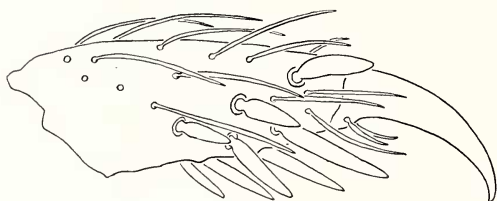
1. Some broad, scale-like setae with five longitudinal ribs between margins inserted on acrotergites; most setae of tergite of eighth abdominal segment either subrectangular in outline (Fig. 22) or ovate (Figs. 19, 23). 2
- All setae of acrotergites slender and usually with not more than three longitudinal ribs visible between margins; setae of tergite of eighth abdominal segment either lanceolate or linear (Figs. 16, 18). 4
2. All setae with smooth margins; scale-like setae of anterior terga broadly lanceolate (Fig. 21); scale-like setae of posterior terga subrectangular (Fig. 22). *Attagenus pello*

- All setae with denticulate margins; scale-like setae of all terga ovate-lanceolate and ovate in form (Figs. 19, 23). ----- 3
3. No antecostal suture present on eighth abdominal tergum. Setae of terga consisting of scale-like hairs only, except for elongate marginal and submarginal erect setae; all setae of discs of terga with single acute apex. ----- *Novelsis varicolor*
 Antecostal suture present on eighth abdominal tergum. Setae of terga consisting of scale-like hairs with some intermingled linear hairs in addition to elongate marginal and submarginal erect setae; some setae on discs of terga with single acute apex and some with two acute apices (Fig. 23). -----
 ----- *Novelsis aequalis*
4. No antecostal suture on eighth abdominal tergum. Spiracular sclerite closed behind by tergum; spiracle enclosed by tergum with distance between spiracle and posterior margin of tergum on first abdominal segment equal to more than one-fourth length of tergite (Fig. 14). --- *Attagenus bicolor*
 Antecostal suture present on eighth abdominal tergum. Spiracular sclerite closed behind by tergum or not, but if closed then distance between spiracle and posterior margin of tergum equal at most to one-sixth length of tergite at midline. ----- 5
5. Setae of dorsum (excluding head) grayish white (transparent in cleared specimens) and contrasting sharply with brownish black setae of abdominal sterna. Integument of each notum with large blackish lateral spot and several smaller blackish spots. ----- *Novelsis uteana*
 Setae of dorsum and setae of abdominal sterna quite similar in color (although setae of head and thoracic sterna sometimes lighter than other setae). Integument of nota not marked with darker spots or, if darker in middle, then not differing in appearance from terga. ----- 6
6. Some setae of eighth abdominal sternum broadly lanceolate with as many as 7 ribs between margins. ----- 7
 All setae of eighth abdominal sternum linear or narrowly lanceolate with at most no more than 4 ribs between margins. -- 9
7. Disc of sterna with lanceolate setae only; row of stout linear setae one to two times as long as lanceolate setae near anterior margin of each abdominal sternum; numerous fine, long, simple setae present anterior to row of stout linear setae. Spiracular sclerite bearing 10 or more setae (Fig. 15). ----- *Attagenus lobatus*

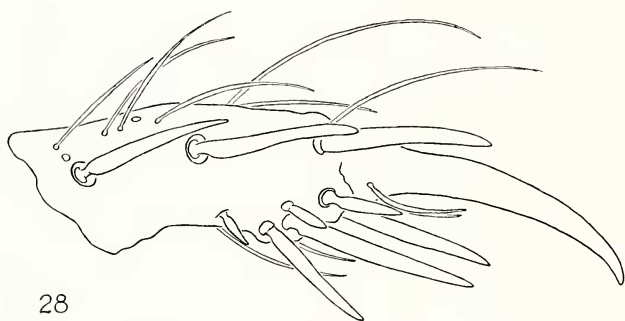
- Anterior abdominal sterna with linear and linear-lanceolate setae; seventh and eighth abdominal sterna with intermingled lanceolate setae and linear setae; setae becoming increasingly smaller toward anterior area of sternum without anterior row of stout linear setae. Spiracular sclerite bearing no more than 6 and usually fewer than 6 setae. ... 8
8. Broadest setae of first abdominal tergite with 4 ribs between margins; broadest setae of eighth abdominal sternum usually with no more than 9 ribs between margins.
 ----- *Attagenus schaefferi*
- Few broad setae of first abdominal tergite with 5 ribs between margins; broadest setae of eighth abdominal sternum in fully mature specimens with 11 or 12 ribs between margins.
 ----- *Attagenus elongatulus*
9. Second antennal segment bearing 12 or more setae.
 ----- *Attagenus fasciatus*
- Second antennal segment bearing no more than 3 and often 2 setae. 10
10. Tergum sclerotized continuously anterior to entire length of tergal margin of spiracular sclerite; spiracle closed behind by tergum, at least on anterior abdominal segments (Figs. 10, 11). Setae inserted on pretarsus subequal in width and length. 11
- Tergum not sclerotized continuously anterior to spiracular sclerite, so that sclerite with associated tergal margin appears to project peninsula-like from postero-lateral angle of tergum. Spiracle opening on margin or at apparent margin of tergum (Fig. 12). Setae inserted on pretarsus unequal, one about twice as wide as other. 12
11. Setae of head identical in color with setae on disc of pronotum (although setae on lateral margins of pronotum may appear darker). Integument of dorsum dark reddish brown except for teneral specimens. All setae on disc of tergites lanceolate except for submarginal erect setae and marginal linear setae. *Attagenus megatoma*
- Setae of head distinctly lighter in color than setae of nota and terga. Dorsal integument straw-colored. Disc of tergites with about equal number of lanceolate and linear setae.
 ----- *Attagenus cyphonoides*
12. Setae of head brownish. Setae of disc of tergites linear and spindle-shaped; margins of setae minutely microserrulate



26



27



28

FIGS. 26-28: Posterior view of front tibiae and pretarsi of mature larvae. Fig. 26. *Attagenus rufipennis*. Fig. 27. *A. fasciatus*. Fig. 28. *A. lobatus*.

(serrations scarcely visible except under high powers of compound microscope) or smooth. One sensory pit close to socket of each submarginal erect seta on abdomen. Epipharynx with two distal sensory pits lacking. -----

----- *Novelsis horni* and *Novelsis andersoni*

Setae of head black. Setae of disc of tergites lanceolate; margins of setae serrulate or denticulate (visible under low powers of compound microscope). Two sensory pits, one on each side, adjacent to socket of each submarginal erect seta on abdomen. Epipharynx with two minute sensory pits distal to median series of 6 sensory pits. ----- *Attagenus rufipennis*

***Attagenus cyphonoides* Reitter**

Attagenus cyphonoides Reitter, 1880 (1881), p. 34.—Zhantiev, 1963b, p. 416.

Attagenus alfieri Pic, 1910, p. 17.—Hinton, 1943, p. 227; 1945, pp. 322–323.

Trogoderma cyphonoides: Arrow, 1915, p. 427.

ADULTS: Described adequately by Hinton (1945).

MATURE LARVAE: Dorsal integument straw-colored. Setae of head golden-yellow; setae of body and legs golden-brown.

Head: Terminal seta of antenna not observed; two setae present near apex of second segment. Epipharynx with distal series of two sensory pits, each subequal in diameter to sensory pits of middle series. Maxillary palp with two setae on penultimate segment. Labium with five to six setae on dorsal (inner) surface of each side of ligula; middle two to three broadly ensiform; outer two to three narrowly ensiform to terete; first segment of palp without seta.

Body setae: Margins and ribs uniformly smooth. Setae inserted on acrotergites all linear, widest with no more than one rib visible between margins. Disc of tergites with linear setae and lanceolate setae; widest lanceolate setae with no more than three ribs visible between margins. Sockets of most submarginal erect setae with two adjacent sensory pits, one on either side near anterior margin. First abdominal sternum with setae at midline longer than other setae of disc; longer setae covered with minute, sharply pointed, imbricate scales; similar setae present along midline of thoracic segments. Setae of sternum of eighth abdominal segment all linear-lanceolate; widest with no more than two ribs between margins; setae becoming smaller on anterior area of sternum; no anterior row of long, stout setae.

Spiracle and associated structures: Spiracle closed behind by tergum; anterior margin more or less straight; posterior margin somewhat thickened. Spiracle somewhat separated from spiracular sclerite (Fig. 10). Spiracular sclerite subcircular to oval, bearing no more than six setae, not enclosed by tergum. Tergum sclerotized

anterior to tergal margin of spiracular sclerite and continuously with it.

Abdomen: Eighth abdominal tergum with well-defined antecostal suture. Ninth abdominal tergum about half as long as length of tergite of eighth abdominal segment. Two small sclerites present in sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg about one-half as wide as long; ventral margin about six-thirteenths as long as length of segment. Tibia of prothoracic leg with usual two ventral rows of spines, one subdorsal apical spine, and row of one to three spines parallel to and very near ventral row. Setae inserted at base of pretarsus subequal in width, extending about as far as middle of claw.

RECORDED DISTRIBUTION: The type locality for *A. cyphonoides* is southern Egypt. *A. alfieri* was also described from Egypt. It occurs as well in Tunisia and Morocco (Zhantiev, 1963a).

NEW RECORDS: *Alabama:* Brawley, August 27, 1954 (C. H. Rothe). *Arizona:* Buckeye, June 27, 1958 (W. B. Morrow); Chloride, July 16, 1957 ("L. L. G."); Elfrida, June 23, 1954 (K. S. Rohwer); Elgin, June, 1954 (J. F. Brantlinger); Gila Bend, June 13, 1957 (L. L. Garrison); Mayer, June 20, 1957 (R. A. Murphy); Mesa, May 8, 1957 (A. M. Mroczkiewicz); Phoenix, May 23, 1957 (A. M. Mroczkiewicz); Randolph (Pinal County), September 27, 1957 (D. A. Bercich); Safford, September 20, 1957 ("W. B. F."); Tucson, July 28, 1954 (R. S. Beal); Tucson, August 11, 1955 (J. R. Boyer). *Kansas:* Dodge City, August 26, 1954 (D. L. Matthew). *New Mexico:* Las Cruces, August 15, 1957 (D. Lucht). *Baja California:* Tecate, May 19, 1955.

DIAGNOSIS: The integument of the adults varies from yellowish brown to a dark chestnut brown. Most of the dorsal hairs are dark brown. The elytra appear unicolorous, but close inspection of each shows an oblique band formed by a few light, golden hairs on the lateral half at the basal fourth. The antenna is 11-segmented. The first two segments of the male antennal club are subequal, and the terminal segment is nearly five times as long as the first two combined. The prosternum has the lateral lobe bent almost vertically in front of the procoxa to form a narrow, transverse, razor-like edge. This character readily separates *A. cyphonoides* from all other species in Group I except *A. fasciatus*, from which it is readily distinguished by the pattern of dorsal pubescence. The middle and hind femora do not have the two ventral carinae on the same or nearly the same plane, as do the other species treated here. The

posterior ventral carina on the apical half of the middle femur lies about two-thirds as far from the dorsal margin as does the anterior ventral carina.

Larvae of *A. cyphonoides*, *A. megatoma*, and *A. fasciatus* are generally quite similar. They may be distinguished from others in Group I by the relatively narrow setae of the abdominal tergites and of the eighth abdominal sternum. The broadest setae in these three species have no more than three ribs between the margins. Mature larvae of *A. cyphonoides* differ from those of *A. fasciatus* in that there are two setae rather than 12 or more on the second segment of the antenna. They differ from larvae of *A. megatoma* in having two rather than no setae on the second segment. They differ from larvae of both *A. megatoma* and *A. fasciatus* in having the setae of the head distinctly lighter in color than the setae of the nota and terga, rather than having the setae of head and dorsum nearly the same color.

***Attagenus megatoma* (Fabricius)**

ADULT MALES: Integument of dorsal and ventral surfaces immaculate, reddish brown to black; antennal club usually with all segments piceous; legs and flagellar shaft of antenna reddish brown to yellowish brown. Pubescence of head and dorsal surfaces sub-recumbent, entirely black or black with varying numbers of light golden-brown hairs on pronotum and base of elytra; ventral pubescence recumbent, light golden-brown except for black hairs on posterior half of fifth visible sternum. Eye slightly emarginate over base of antenna. Antenna 11-segmented; ratio of combined length of first two segments of club to length of terminal segment varying from 1:2.8 to 1:3.4; ratio of length of terminal segment to length of pronotum and elytra combined varying from 1:9.00 to 1:11.77; club clothed with fine, erect hairs about one-third as long as width of third antennal segment. Channel below eye for reception of flagellar shaft of antenna concave with anterior margin forming carina visible from front of head (Fig. 3); carina projecting knife-like beneath head and curved behind base of maxilla to meet gular suture. Pronotum with lateral carina continued around anterolateral angle; basal lobe feebly rounded to slightly truncate and not distinctly produced backward; setae on posterior margin of lobe not appreciably longer than other setae of pronotum. Punctures of pronotal disc varying in diameter from width of one to width of two diameters of facet of eye; punctures nearly contiguous laterally,

especially on anterior half of pronotum, with anterior margins more sharply defined than posterior margins so that pronotum somewhat transversely rugose. Elytron with punctures of disc about twice diameter of facet of eye and separated by one to two diameters of single puncture. Hairs of disc about as long as combined length of fourth and fifth segments of antenna. Hypomer on slightly concave; forming lobe behind trochantin so that trochantin visible only through narrow slit (Fig. 9). Prosternum with posterior margin of lateral lobe reflected against procoxa; reflected part about as long as length of horizontal part of lobe and forming angle of about 45° with horizontal part; prosternal process slightly wider at apex than between coxae; ventral surface of process thin and knife-like; no thread-like carina extending from process onto disc, but disc longitudinally elevated at middle and broadly carina-like; no transverse thread-like carina present near anterior margin of disc, but denticle present at middle near anterior margin. Epipleuron terminating a little behind hind margin of metepimeron. Ventral plate of hind coxa forming more or less acute tooth lateral to insertion of trochanter; plate extending laterad behind posterior margin of metepisternum and meeting metepimeron (actually extending beneath inner margin of metepimeron). Protibia not carinate on dorsal margin. Mesofemur with anteroventral and posteroventral margins of crural cavity about equally produced and nearly on same plane. Length (of pronotum and elytra combined): 2.8 mm. to 4.0 mm.

ADULT FEMALES: Antennal club with first two segments usually reddish brown and terminal segment piceous; terminal segment subequal to one and one-half times length of ninth and tenth segments combined; tenth segment about five-sixths as long as ninth segment. Length (of pronotum and elytra combined): 3.9 mm. to 5.0 mm.

MATURE LARVAE: Integument of head and dorsum dark reddish brown. Setae of head and body dark golden-brown.

Head: Antenna with terminal seta subequal in length to length of terminal segment; second segment without setae. Epipharynx with distal series of two sensory pits, each subequal in diameter to diameter of sensory pits of middle series. Maxillary palp with two and occasionally three setae on third segment. Labium usually with six setae on dorsal (inner) surface of each lobe of ligula; three inner setae ensiform; three outer setae slender; first segment of palp without seta.

Body setae: Margins and ribs uniformly smooth. Acrotergites with small, linear-lanceolate, indistinctly ribbed setae and numerous

simple setae. Setae on tergites linear-lanceolate with two or three ribs between margins (Fig. 16). Sockets of submarginal erect setae usually with two adjacent sensory pits, one on each side. Sterna with linear-lanceolate setae with two ribs between margins and occasionally some with three ribs between margins; setae becoming smaller on anterior area of each sternum without row of stouter setae near anterior margin; first and second abdominal sterna with several setae along midline much longer than other setae of disc.

Spiracle and associated structures: Spiracle closed behind by tergum; anterior margin more or less straight; posterior margin somewhat thickened; spiracle slightly removed from spiracular sclerite. Spiracular sclerite oval, not enclosed by tergum, bearing six or fewer setae. Tergum sclerotized anterior to tergal margin of spiracular sclerite and continuous with it (Fig. 11).

Abdomen: Eighth abdominal tergum with antecostal suture. Ninth abdominal tergum about two-thirds as long as tergite of eighth segment. Two small sclerites in sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg half as wide as long; ventral margin two-fifths as long as length of segment. Tibia of prothoracic leg with usual two rows of ventral setae; posterior face with subdorsal apical spine and row of five to seven subventral spines above posterior row of ventral spines. Setae inserted at base of pretarsus subequal in width and length, extending almost to middle of claw.

INTERNAL ANATOMY: Details of the digestive tract, Malpighian tubules, bands of oenocytes, and reproductive systems have been described by Dunkel and Boush (1968a). The internal anatomy of no other species in the tribe has been investigated, so no comparative data are available for evaluating the significance of the interesting structures which these authors found.

NOMENCLATURE: Although the name *A. piceus* has been applied to several species in the United States, it properly applies to this species alone. However, the name is unavailable, since *Dermestes piceus* Olivier (1790) is a primary junior homonym of *Dermestes piceus* Thunberg (1781) and was treated as such by early authors.

The oldest available name is *Dermestes unicolor* Brahm (1791). This name was not used by any subsequent author until Mroczkowski (1968) recognized the identity of Brahm's type and listed the name in his catalogue. It is unfortunate that it was not treated by Mroczkowski as a *nomen oblitum*. A request is currently before the International Commission on Zoological Nomenclature to suppress the name and to conserve the name used here.

The next available name for the species is *Dermestes megatoma* Fabricius (1798). Latreille erected the genus *Attagenus* in 1802, and after that almost all authors used the combination *A. megatoma* for the species until Mulsant and Rey in 1868 resurrected the name *A. piceus*. Lacking a code, many nineteenth century authors simply accepted the authority of Mulsant and Rey, and the propriety of the name was not subsequently questioned by any American writer. Nevertheless, the name *A. megatoma* has been used by a number of recent European workers, as can be seen from the table of synonymy for *A. megatoma megatoma*.

DISTRIBUTION IN NORTH AMERICA: This is a polytypic species, probably originally Holarctic in distribution but now nearly cosmopolitan as a result of introductions by commerce. Two geographically distinct forms are clearly present in the Nearctic region: one occurring mostly in Canada and in the northern tier of states but dipping as far south as Utah and Iowa, the other widespread throughout the remaining states. The latter (southern) form is indistinguishable from the nominate European subspecies and may represent an early introduction to the United States. The northern form resembles the Far Eastern *A. megatoma japonicus* Reitter and possibly originated from it, migrating across the former land bridge between Alaska and northeastern Asia. In spite of the resemblances, however, there appear to be enough differences between the forms that they should be regarded as distinct subspecies.

Casey (1916) named the northern form *A. canadensis*, considering it a distinct species. I believe it deserves no more than subspecific status, because intergrades are frequently found in areas where it comes together with the southern form and because cross-breeding experiments seem to show that gene exchange between the two forms is possible. In several experiments first generation hybrids were readily formed between a stock culture of "*megatoma*" obtained from Prescott, Arizona, and a stock culture of "*canadensis*" from Vancouver, British Columbia. When the hybrids were mated, second generation progeny were produced and developed into adults in several, but not all, of the experiments. The failures in the second generation crosses do not necessarily mean there is reduced fertility between the hybrids, since I was compelled to move my laboratory during the experiments, and the cultures were not kept in an adequately moist atmosphere for some length of time. At any rate, the ability of some hybrids to mate and produce viable progeny seems

established and indicates the probability of the same thing taking place in the wild state.

The accompanying map (Fig. 29) shows the distribution of the two forms. Most specimens of *A. megatoma megatoma* have no golden-brown hairs inserted on the elytra. Most specimens of *A. megatoma canadensis* have golden-brown hairs inserted in some numbers on the base of the elytra back to a distance at least equal to three lengths of the scutellum. First generation hybrids between such forms have golden-brown hairs inserted on the base of the elytra no further back than one length of the scutellum. Using the hybrids as a rough standard, I have designated as an "intergrade" any specimen with golden-brown hairs on the base of the elytra where the hairs are inserted no further back than one and one-half times the length of the scutellum. Localities where such intergrades have been found are shown on the map with a triangle, even though one or both of the other forms may have been found in the same locality. The pattern of distribution exhibits a less regular line of demarcation between the forms than might be expected, but this irregularity is probably explained by the movement of the forms through commerce. If *A. megatoma megatoma* is an indigenous subspecies, I doubt that western Oregon and Washington are within its original range.

ECOLOGY AND LIFE HISTORY: Hinton (1945) summarized the immense amount of work done on the life history, habits, and economic importance of the species. Regrettably, there is no way of knowing which of the studies listed refer to *A. megatoma* and which to *A. elongatulus*. Probably the life histories are very similar. Nevertheless, it would be unsafe to assert that any of the facts cited are true of *A. megatoma* without access to the specimens used in the experiments or without replicating the experiments with accurately identified and unmixed cultures. It is particularly unfortunate that the experiments of Griswold and Greenwald (1941) on the life history of "*A. piceus*" cannot at present be assigned definitely to one species or the other.

Most of the reliable available information on the ecology of the species has been gathered for *A. megatoma megatoma*. The information that follows refers to this subspecies, unless otherwise noted. In each instance the identity of the species and subspecies has been verified. Out-of-doors the species is not uncommonly found in various bird nests. It was taken by E. G. Linsley at Madera, California, in the nests of cliff swallows, by Mrs. K. B. Wetherbee in a

tree swallow nest in Connecticut, by W. L. McAtee in a starling nest at Bell, Maryland, and by A. T. McClay in an English sparrow nest at Medford, Oregon. J. A. Payne collected one larva in owl pellets at Clemson, South Carolina. In addition to these records, Ellis A. Hicks (1959) has assembled a long list of references to the occurrence of the species in various kinds of bird nests. Probably most of the references apply to this species, but very likely some refer to *A. elongatulus* or other similar-appearing species. The species is not limited to bird nests and possibly may occur as commonly in some other out-of-door situations that up to the present have not been as thoroughly canvassed. I collected the species in a *Sceliphron* mud dauber nest at Chino Valley, Arizona. Johansen and Eves (1966) published a report of *A. megatoma canadensis* (under the name *A. piceus*) as an occasional pest in the Pacific Northwest in nests of the alfalfa leafcutting bee, *Megachile rotundata* (Fabricius). E. S. Ross found a specimen in a *Geomys* (pocket gopher) burrow in Somerset, Texas.

The species is not uncommonly found in human habitations, although probably not as frequently now since the advent of synthetic fibers in the manufacture of rugs, overstuffed furniture, and the like. It is probably best known as an inhabitant of granaries, seldom in any numbers in the grain bulk, unless the store is fairly old, but rather in grain dust on the stringers and on old spilled grain in corners and under floor boards. Triplehorn (1965) carried out a survey of insects in Ohio grain elevators and feed mills and found it in 110 out of 118 establishments investigated, a far higher rate of occurrence than found for any other insect. *A. megatoma canadensis* was found by Chao (1954) to be similarly prevalent in grain elevators at Albion and Pullman, Washington. Following a survey he assigned five categories of frequency to the insects found and rated this species (under the name *A. piceus*) in the most frequently occurring group.

The feeding habits of the larvae have been investigated in the laboratory, though not in comparison with other species. Hence, such questions as whether this species or *A. elongatulus* is the more important depredator of woolens and other animal fibers remain unanswered. Mallis, Miller, and Hill (1958) found that the species will feed extensively on wool and on various combinations of wool and synthetic fabrics. It will feed to a slight extent on silk crepe and on nylon but little or not at all on dynel, dacron, orlon, vicara, acetate rayon, viscose rayon, linen, and cotton percale. It will feed more extensively on nylon stained with human perspiration, but

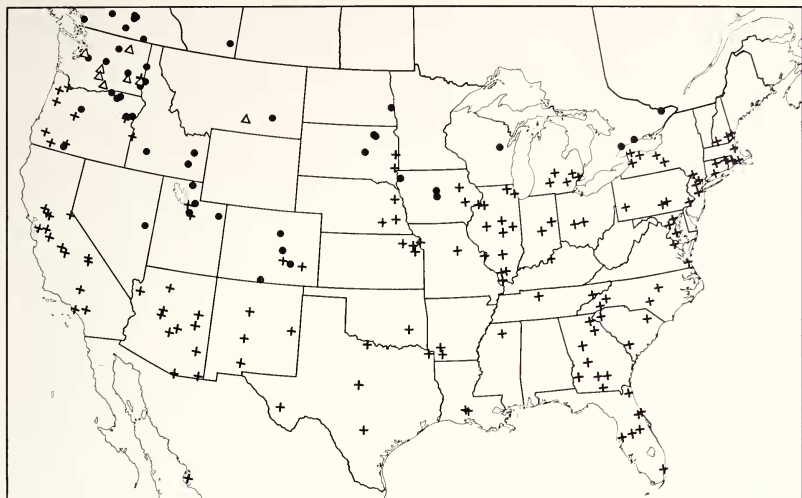


FIG. 29. Nearctic distribution of subspecies of *Attagenus megatoma*: + = *A. megatoma megatoma*, ● = *A. megatoma canadensis*, △ = intergrades between subspecies. See text for further explanation.

not on nylon stained with human urine or tomato juice (Mallis, Miller, and Hill, 1959). I have been able to rear the larvae successfully on dried dog food and on oatmeal. The species has been found infesting cereal products including bran, barley, ground Indian corn, in-shell peanuts, cake mix, and alfalfa meal. The species was found infesting stored raisins in Fresno, California, but may have been feeding on the remains of other insect pests rather than on the raisins. Little accurate information is available on the kinds of food that will permit maturation of the organism or that might govern the rate of maturation. Boush, Dunkel, and Burkholder (1969) have found that sorbic acid incorporated in the diet does not affect larval or adult weight, survival to adult stage, or pupal or adult longevity. However, mated pairs fed the chemical produced progeny unable to survive the first larval instar. The significance of this finding is not clear at the present time.

Mallis, Burton, and Miller (1962) experimented with the extent to which the larvae might be attracted to various food stains, including minerals, proteins, B vitamins, cholesterol, vitamin D, vitamin A, and cottonseed oil, and found them relatively unattracted to any. There was some positive attraction to stains made by glucose, orange juice, and tomato juice. Small but not large larvae were

attracted definitely to stains made by human urine, tomato juice, and beer, but only at times to stains made by human perspiration, milk, black coffee, and beef gravy (Mallis, Miller, and Hill, 1959). No larvae were attracted to tea, cola syrup, or butter stains.

Adults reared in the laboratory regularly mate and lay fertile eggs without the opportunity of flying and without being provided with water or food other than the cereal on which the larvae are reared. Out-of-doors adults have been taken on flowers of *Spiraea* (Mroczkowski, 1958), *Achillea*, and *Castanea*. Adults of *A. megatoma canadensis* have been collected on alsike clover and on sweet clover. Whether adults feed on the pollen or nectar of the flowers has not been ascertained. It is possible that attraction to flowers is a mechanism bringing individuals together for purposes of mating. Yokoyama (1932, cited in Hinton, 1945) noted that mating usually takes place on a flower or some other place exposed to the sun.

SYMBIONTS: The eugregarine *Pyxinia frenzeli* Laveran and Mesnil has been found within cells of the midgut epithelium of the larvae (Dunkel and Boush, 1968b). The protozoan is not found in the adult, except that newly emerged adults contain what is presumed to be a remnant of the larval midgut in the form of an elongated tube, closed at both ends, within which spores and encysted forms are found (Dunkel and Boush, 1968a). The tube is probably eliminated in the first defecation of the adult. In all probability the protozoan should be considered a commensal rather than a parasite. Heavily infested individuals do not show differences in weight, survival, or length of life cycle compared with non-infested individuals (Dunkel and Boush, 1968b). No survey has been made of the extent to which populations are infested in different parts of the range of the species. The specimens studied by Dunkel and Boush were from a laboratory strain maintained at the University of Wisconsin.

The muscardine fungus *Beauveria bassiana* (Bals.) Vuill. has been recorded as a parasite of the species (Charles, 1941). This is a generalized parasite best known from its occurrence on the chinch bug and the European corn borer. The identity of the species of *Attagenus* on which it was described might be questioned. Possibly it attacks all species in the group to which *A. megatoma* belongs, but this theory should be verified.

***Attagenus megatoma megatoma* (Fabricius)**

Dermestes piceus Olivier, 1790 (*non* Thunberg, 1781), p. 10, pl. 1, fig. 4.
Dermestes unicolor Brahm, 1791, p. 144.

Dermestes megatoma Fabricius, 1798, p. 313.

Attagenus megatoma: Dahl, 1823, p. 30.—Laporte, 1840, p. 35.—Erichson, 1846, p. 441.—Wollaston, 1854, p. 204.—LeConte, 1854, p. 109.—Chevrolat, 1863, p. 616.—Howe, 1952, p. 40.—Mroczkowski, 1954, p. 7; 1958, p. 4; 1962, p. 6; 1965, p. 668.—Zhantiev, 1963b, p. 421.

Attagenus piceus: Mulsant and Rey, 1867 (1868), p. 69.—Jayne, 1882, p. 355.—Casey, 1900, p. 146.—Ganglbauer, 1904, p. 24.—Lutz, 1911, p. 152.—Mutchler and Weiss, 1927, pp. 10–11.—Moore and Moore, 1942, p. 288.—Rees, 1943, pp. 14–17.—Hinton, 1943, p. 227; 1945, pp. 309–319.—Korschefsky, 1944, p. 147.—Armstrong, 1945, p. 48.—Zinkernagle, 1952, p. 844.—Zinkernagle and Muller, 1952, p. 156.—Hatch, 1962, p. 283.

Attagenus cylindricornis Casey, 1900 (?*non cylindricornis* Say, 1825), p. 147 (New synonymy).

Attagenus deficiens Casey, 1900, p. 146 (New synonymy).

ADULT MALES: Dorsal pubescence black except for few golden hairs at basal third along extreme lateral margin of pronotum and narrow band of short golden to golden-brown hairs along basal margin of pronotum; pronotal band not always distinguishable but when visible not more than half length of scutellum at longest point; often few dark golden hairs scattered among black hairs of pronotum, particularly at sides; rarely dorsal pubescence entirely black. Ratio of length of last segment of antennal club to combined length of pronotum and elytra varying from 1:7.9 to 1:9.9.

DISTRIBUTION: The distribution of the subspecies in the United States is shown in Figure 29.

DIAGNOSIS: This subspecies is easily recognized by its almost entirely black dorsal pubescence. Some golden-brown or golden hairs may be scattered among the black hairs of the pronotum, particularly on the sides, but they do not form patches that contrast with the dark discal area. The last segment of the antennal club of the male tends to be a little longer in proportion to the length of the body than does the last segment of the club in *A. megatoma canadensis*.

***Attagenus megatoma canadensis* Casey, new status**

Attagenus canadensis Casey, 1916, p. 183.

Attagenus piceus: Spencer, 1947 (1948), p. 7.

Attagenus piceus ab. *sordidus* Hatch, 1962 (*non* Heer, 1841), p. 283.

ADULT MALES: Dorsal pubescence black except for concentration of golden to golden-brown hairs on posterior margin and latero-posterior angles of pronotum and on base of elytra; light-colored

hairs of pronotum occasionally covering most of sides of pronotum; light-colored hairs of elytra quite dense at base but intermingled with increasing numbers of black hairs posteriad; light-colored hairs inserted posteriad two to four lengths of scutellum from base. Ratio of length of terminal segment of antennal club to length of pronotum and elytra combined varying from 1:9.0 to 1:11.4.

TYPE LOCALITY: Ottawa, Canada. The specimen that has been labeled as the type in the Thomas L. Casey Collection at the United States National Museum bears a somewhat illegible locality label that might possibly be read "Ott." Since Ottawa is one of the localities Casey indicated for the species, it is reasonable to limit it as the type locality. I herewith formally designate the specimen, which is a female, as the lectotype.

DISTRIBUTION: The known distribution is shown in Figure 29. Additional collecting is needed to establish the range of distribution of the subspecies northward in Canada and to clarify its points of contact with the nominate subspecies.

DIAGNOSIS: Adults of the subspecies may be distinguished from the nominate subspecies by the golden to golden-brown hairs that occupy the lateroposterior angles of the pronotum and form patches with almost no intermingled dark hairs. The light-colored patches stand out in contrast to the dark disc of the pronotum. In addition, there is a band of light-colored hairs on the base of the elytra. Posteriad it may be broken into somewhat irregular lines or may be intermixed with increasing numbers of dark hairs. Usually no light-colored hairs are inserted further back from the base than four times the length of the scutellum, often no further back than two times the length of the scutellum. Forms with light-colored hairs no further back than one and one-half times the length of the scutellum appear to occur only in the zones of intergradation between the two subspecies. No differences have been observed between larval forms of the two subspecies.

***Attagenus elongatulus* Casey**

Attagenus elongatulus Casey, 1900, p. 147.

Attagenus extricatus Casey, 1900, p. 146 (New synonymy).

Attagenus bicolor Casey, 1900 (*non bicolor* Harold, 1868), p. 147.

ADULT MALES: Integument of body yellowish or reddish brown to black; elytra often somewhat lighter in color than pronotum; legs and antenna yellowish brown except for darker brown terminal antennal segment. Pubescence of head and dorsal surfaces sub-

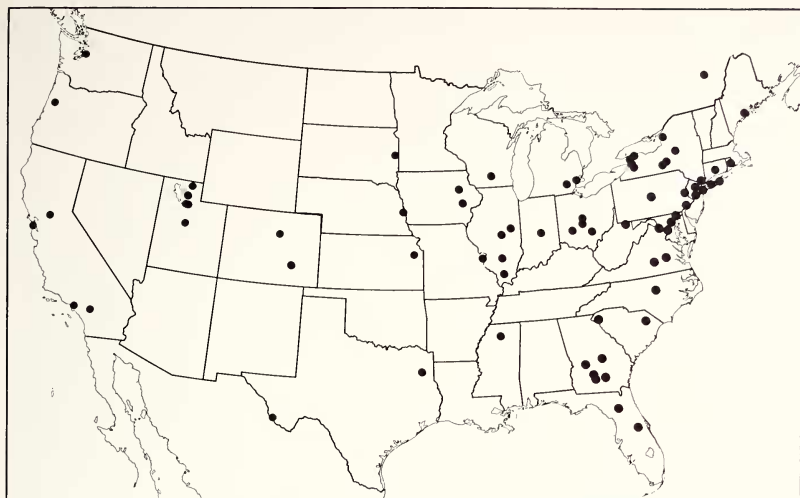


FIG. 30. Nearctic distribution of *Attagenus elongatulus*.

recumbent, black except for band of light golden-brown hairs along basal margin of pronotum; length of light-colored band at widest point (i.e., longest anterior-to-posterior distance) four-fifths to one and one-fourth times as long as scutellum; additional light golden-brown hairs either present or not along lateral margins of pronotum, along anterior margin of pronotum, along lateral margins of elytra at basal fourth, and at base of elytra; if golden brown hairs present at base of elytra these intermingled with black hairs and not inserted posteriad beyond length of scutellum; ventral pubescence recumbent, light golden-brown except for numerous black hairs on posterior half of fourth and on fifth visible sterna. Head with eye slightly emarginate over base of antenna. Antenna 11-segmented; ratio of combined length of first two segments of club to length of terminal segment varying from 1:3.2 to 1:4.2; ratio of length of terminal segment to length of pronotum and elytra combined varying from 1:6.2 to 1:7.6; club clothed with fine, erect hairs about one-third as long as width of third antennal segment. Channel below eye for reception of flagellar shaft of antenna concave with anterior margin forming carina; margin of carina barely visible from front of head; carina projecting knife-like beneath head and curved behind base of maxilla to meet gular suture. Pronotum with lateral carina continued as well-defined carina around anterolateral angle; basal lobe feebly

rounded and not distinctly produced posteriad; setae on posterior margin of lobe about twice as long as light-colored setae on basal margin on either side of lobe. Punctures of pronotal disc varying in diameter from width of one to width of two facets of eye; anterior margins more sharply defined than posterior margins with punctures nearly contiguous laterally, especially on anterior half of pronotum, so that pronotum somewhat transversely rugose. Elytron with punctures of disc about twice diameter of facet of eye and separated by one to two diameters of single puncture. Hairs of disc of elytron no longer than combined length of third and fourth segments of antenna. Hypomerion moderately concave. Posternum with posterior margin of lateral lobe reflected against procoxa; reflected part about as long as horizontal part of lobe and forming angle of about 45° with horizontal part; prosternal process slightly wider at apex than between coxae; carina extending from apex of process onto disc and terminating at denticle near anterior margin of disc; carina broad and granulate on disc but thread-like on process; lateral carina present near anterior margin separating disc from anterior declivity. Epipleuron terminating little behind hind margin of metepimeron. Ventral plate of hind coxa somewhat expanded laterad to insertion of trochanter to form obtusely angled or somewhat rounding tooth; plate extending laterad behind posterior margin of metepisternum and meeting metepimeron (actually extending beneath inner margin of metepimeron) (Fig. 4). Protibia not carinate on dorsal margin. Mesofemur with anteroventral and posteroventral margins of crural cavity about equally produced and nearly on same plane. Length (of pronotum and elytra combined): 2.9 mm. to 3.9 mm.

ADULT FEMALES: Antennal club with first two segment yellowish brown to dark brown; all segments usually same color but occasionally terminal segment darker; terminal segment subequal to one and one-half times as long as ninth and tenth segments combined; tenth segment about five-sixths as long as ninth segment. Length (of pronotum and elytra combined): 3.6 mm. to 5.0 mm.

MATURE LARVAE: Integument of head and dorsum light brown. Setae of head and body golden-brown.

Head: Antenna with terminal segment subequal in length to length of third segment; no setae present on second segment. Epipharynx with distal series of two sensory pits, each subequal in diameter to sensory pits of middle series. Maxillary palp with two setae on penultimate segment. Labium with six to seven setae on dorsal (inner) side of each lobe of ligula; medial setae narrowly

ensiform with setae becoming progressively narrower laterad; first segment of palp without seta.

Body setae: Margins and ribs uniformly smooth. Setae inserted on acrotergites all linear, most with no more than one rib between margins but some with two and rarely with three ribs between margins. Disc of tergite with linear and linear-lanceolate setae; linear-lanceolate setae with as many as five ribs between margins. Sockets of submarginal erect setae with two adjacent sensory pits, one on each side near anterior margin. First abdominal sternum with setae along midline longer than on remainder of disc. Setae of sternum of eighth abdominal segment consisting of linear-lanceolate and lanceolate hairs; lanceolate setae with eight to twelve ribs between margins (Fig. 20); setae becoming smaller on anterior area of sternum without anterior row of stouter setae.

Spiracle and associated structures: Anterior abdominal segments with spiracle closed behind by tergum; anterior margin of spiracle more or less straight; posterior margin somewhat thickened; spiracle adjacent to spiracular sclerite. Spiracular sclerite oval, not enclosed by tergum; five or fewer setae inserted on sclerite. Tergum sclerotized anterior to tergal margin of spiracular sclerite and continuous with it (similar to Fig. 11).

Abdomen: Eighth abdominal tergum with well-defined antecostal suture. Ninth abdominal tergum more than half as long as tergite of eighth abdominal segment. Two small sclerites present in sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg about 9/20 as wide as long; ventral margin about 9/20 as long as length of segment. Tibia of prothoracic leg with usual two rows of ventral setae; posterior face with subdorsal apical seta and longitudinal row of three setae along middle of segment; most proximal seta in row inserted little before middle of segment. Setae inserted at base of pretarsus subequal in width, extending about as far as middle of claw.

TYPE LOCALITY: Recorded as "Nebraska to Utah." A female in the Thomas L. Casey Collection at the United States National Museum has been labeled the type. This specimen is herewith formally designated the lectotype. It bears a locality label with the word "Utah," so the type locality should be restricted to this state.

NOMENCLATURE: Casey quite evidently did not understand the limits of this species. On the one hand, a second specimen from Utah that stands under this name in his collection is actually *A. bicolor*. On the other hand, two specimens standing under *A. bicolor*

and a number of specimens standing under *A. cylindricornis* in his collection belong to this species. The type of *A. extricatus* appears to belong here, although the specimen is rubbed and identification is difficult. However, five other specimens that Casey arranged under *A. extricatus*, apparently after the original description, belong unquestionably to *A. megatoma*. *A. elongatulus* is quite similar to the European *A. brunneus* Faldermann. Nevertheless, the specimens of *A. brunneus* I have had available for study seem vaguely different, and I am unwilling to place *A. elongatulus* in synonymy without an opportunity to compare longer series and preferably to compare immature stages.

DISTRIBUTION: The species has an irregular distribution, suggesting that it is introduced and tending to confirm the suspicion that it is a synonym of *A. brunneus* or some other inadequately described, exotic species. Because the distribution is so widespread, it seems adequate to exhibit it on a map (Fig. 30) without detailing every locality.

DIAGNOSIS: This species is very clearly distinct from *A. megatoma*, although doubtless much of the American economic literature on "*A. piceus*" refers to it. Adult males can be distinguished by the relatively longer terminal segment, as indicated in the key, although this is a character requiring careful measurement. Females as well as males may be distinguished from *A. megatoma megatoma* by the presence of a band of light-colored hairs along the base of the pronotum, the band being about as long at its longest point as the length of the scutellum. If such a band is present in *A. megatoma megatoma*, at its longest point it is no more than half as long as the scutellum. *A. elongatulus* often has a few scattered golden-brown hairs at the base of the elytra but usually has no golden-brown hairs on the pronotum other than those mentioned. *A. megatoma canadensis* ordinarily has a large number of golden-brown hairs on the pronotum, particularly at the lateroposterior angles, and has a number of golden-brown hairs on the base of the elytra. Nonetheless, some adult female specimens of *A. megatoma canadensis* or intergrades between it and *A. megatoma megatoma* may be nearly impossible to distinguish from *A. elongatulus*. *A. elongatulus* also closely resembles some adult forms of *A. schaefferi* but may be distinguished from them by the 11- rather than 10-segmented antenna. Adults of *A. elongatulus* somewhat resemble those of *A. cyphonoides*, but careful inspection of the latter will always reveal the presence of at least a few lighter hairs forming a subbasal oblique band on

the elytron. No such band is found on the elytron of *A. elongatulus*. Furthermore, the pronotum of *A. cyphonoides* is covered with lighter golden-brown hairs instead of the lighter hairs being limited to a band along the basal margin. Little difficulty should be encountered in distinguishing adults of this species from other Nearctic Attagenini.

The larvae of this species are easily separated from all other known Nearctic species except those of *A. schaefferi*. Both *A. elongatulus* and *A. schaefferi* have, inserted on the eighth abdominal sternum, a number of distinctively broad, lanceolate setae, each with eight to twelve ribs between the margins. With the exception of *A. lobatus* all other species have either subrectangular or ovate setae on this sternum or have linear or narrowly lanceolate setae with no more than four ribs between the margins. *A. lobatus* is easily distinguished from *A. elongatulus* by having a row of stout linear setae near the anterior margin of each sternum, in front of which are numerous fine, long, simple setae. No such row of stout setae is found on the sterna of *A. elongatulus*. No completely definitive characters have been found by which larvae of *A. elongatulus* and *A. schaefferi* may always be distinguished. Possibly last instar larvae of the two can always be separated by the broader tergal and sternal setae of *A. elongatulus*. However, it is often impossible to know whether the specimens one is comparing are fully mature.

ECOLOGY: The following rather limited data are all I have been able to refer with certainty to this species. Adults have been collected from flowers of the catclaw, *Acacia greggii* A. Gray, in Presidio, Texas, on *Spiraea* in Ithaca, New York, and by sweeping celery and beets in Utah. Adults have occasionally been taken at lights. Larvae have been found feeding on woolens in Urbana, Illinois, by Carl Weinman and in Tifton, Georgia, by J. A. Payne. Adults and larvae have been taken quite frequently in homes, amounting on occasions to pests of minor importance, but no records have been kept of the materials on which they were feeding. L. F. Hoyt found the species infesting dried buttermilk in Buffalo, New York, and it has been found as a pest in dried milk in Omaha, Nebraska. J. A. Payne found the species infesting in-shell peanuts that had been in storage for four years at Douglas, Georgia.

LIFE HISTORY: Nothing has been published, unless this species is indeed a synonym of another species. H. S. Barber left a note in the collection of the United States National Museum indicating that a specimen he reared to maturity passed through 24 larval instars.

That this species is incapable of crossbreeding with *A. megatoma*

was demonstrated by Moore and Moore (1942). The "yellow" larvae of the Moores' experiments were this species and the "black" larvae were *A. megatoma*. W. E. Burkholder (*in litt.*) has verified these results in recent experiments.

***Attagenus schaefferi* (Herbst)**

ADULT MALES: Integument of dorsal and ventral surfaces immaculate, light brown to black; legs and antennae light brown to dark brown; terminal segment of antennal club brown to black. Pubescence of head and dorsal surfaces subrecumbent, golden-yellow to black, with or without intermingled lighter-colored hairs; ventral pubescence recumbent, black with intermingled light golden-brown hairs on legs to entirely light golden-brown. Head with eye not at all emarginate to shallowly but clearly emarginate over base of antenna. Antenna 10-segmented; ratio of combined length of first two segments of club to length of terminal segment varying from 1:4.7 to 1:7.1; ratio of length of terminal segment to length of pronotum and elytra combined varying from 1:4.4 to 1:5.7; club clothed with fine, erect hairs about one-third as long as width of third antennal segment. Channel below eye for reception of flagellar shaft of antenna concave with anterior margin forming carina; margin of carina visible from front of head; carina projecting knife-like beneath head and curved behind base of maxilla to meet gular suture. Pronotum with lateral carina continued well-defined around anterolateral angle; basal lobe feebly rounded and not distinctly produced backward; setae on posterior margin of lobe as long as to not more than one-third longer than other setae of pronotum. Punctures of pronotal disc as small as or smaller than facet of eye, separated by one to three diameters of single puncture but sometimes feebly joined laterally so that pronotum somewhat transversely rugose. Elytron with punctures of disc one to one and one-half times diameter of facet of eye and separated by one to one and one-half times diameter of single puncture. Hairs of disc of elytron about as long as or slightly longer than third segment of antenna. Hypomeron slightly concave. Prosternum with posterior margin of lateral lobe reflected against procoxa; reflected part not as long as horizontal part and curving to form angle of about 30° with horizontal part; prosternal process slightly wider at apex than between coxae; carina of process not extended onto disc of prosternum; anterior declivity of prosternum sometimes separated from disc by thin transverse thread-like carina; denticle at anterior margin

of disc present or not. Epipleuron terminating gradually about middle of first abdominal sternum. Ventral plate of hind coxa forming obtuse or acute tooth lateral to insertion of trochanter and extending laterad beneath inner margin of metepimeron (i.e., appearing to meet metepimeron behind metepisternum). Protibia not carinate on dorsal margin. Mesofemur with anteroventral and posteroventral margins of crural cavity about equally produced and nearly on same plane. Length (of pronotum and elytra combined): 3.2 mm. to 4.2 mm.

ADULT FEMALES: Terminal segment of antennal club 1.3 to 1.7 times length of eighth and ninth segments combined; ninth segment subequal in length to eighth segment. Length (of pronotum and elytra combined): 3.8 mm. to 5.3 mm.

MATURE LARVAE: Integument of head and dorsum light brown. Setae of head and body golden-brown.

Head: Antenna with terminal seta subequal in length to length of third segment; no setae present on second segment. Epipharynx with distal series of two sensory pits, each subequal in diameter to sensory pits of middle series. Maxillary palp with two or three setae on penultimate segment. Labium with five to six setae on dorsal (inner) side of each lobe of ligula; middle setae narrowly ensiform with setae becoming progressively narrower laterad; first segment of palp without seta.

Body setae: Margins and ribs uniformly smooth. Setae inserted on acrotergites all linear, most with no more than one rib between margins but few sometimes present with two ribs between margins. Disc of tergite with linear and linear-lanceolate setae; linear-lanceolate setae with as many as four ribs between margins. Sockets of submarginal erect setae with two adjacent sensory pits, one on each side near anterior margin. First abdominal sternum with longer setae along midline than on remainder of disc. Setae of sternum of eighth abdominal segment consisting of linear-lanceolate and lanceolate hairs; lanceolate setae with seven to nine ribs between margins; setae becoming smaller on anterior area of sternum without row of stouter setae near anterior margin.

Spiracle and associated structures: Anterior abdominal segments with spiracle closed behind by tergum; anterior margin of spiracle more or less straight; posterior margin somewhat thickened; spiracle adjacent to spiracular sclerite. Spiracular sclerite oval, not enclosed by tergum; five or fewer setae inserted on sclerite. Tergum sclerotized anterior to tergal margin of spiracular sclerite.

Abdomen: Eighth abdominal tergum with well-defined antecostal suture. Ninth abdominal tergum more than two-thirds as long as tergite of eighth abdominal segment. Two small sclerites present in sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg half or slightly more than half as wide as long; ventral margin about two-fifths as long as length of segment. Tibia of prothoracic leg with usual two rows of ventral setae; posterior face with subdorsal apical seta and longitudinal row of three setae along middle of segment; most proximal seta in row inserted slightly before middle of segment. Setae inserted at base of pretarsus subequal in width, extending about as far as middle of claw.

SYSTEMATICS: Varieties of *A. schaefferi* (Herbst, 1792) have long been known to exist in the United States but have been considered by all previous workers as no more than accidental introductions of the species from Europe. A careful study of the populations in the United States seems to indicate that this assumption is incorrect. The Nearctic forms are seldom found as pests in stored products or houses, yet occur commonly in the most remote areas of the West, often far from human habitation. If the forms had been introduced, they would be expected in centers of commerce or human activity. Furthermore, a number of geographic segregates are discernible in different areas of the West, a phenomenon not expected in a recently introduced species. Finally, the forms that are present in most areas of the United States appear to be distinguishably different from forms that have been described for the Palearctic region.

A measurable difference between European and Nearctic forms is found in the ratio of the length of the last antennal segment of the male to the total length of the pronotum and elytra. A large number of Nearctic specimens has been measured and the ratio found always to vary within the range of 1:4.67 to 1:5.67. Only four European males were available for study, but these all fell outside this range, varying from 1:4.40 to 1:4.65. These differences are small and, if a large number of European forms should be measured, no doubt it would be found that some overlap occurs in the ranges of variation. Another difference, but one difficult to measure, appears to be the degree of concavity of the epipleuron. In the Palearctic specimens I have examined the epipleuron is quite concave, but in most Nearctic specimens it is nearly flat or only slightly concave. These differences, taken with the evidence that the Nearctic forms are indigenous,

make it desirable to recognize the Nearctic forms as taxonomically distinct. Accordingly, I am designating the American forms as subspecies of the Palearctic form. The subspecies category preserves the apparent relationship with the Palearctic form while providing suitable names for reference to the American forms.

The various Nearctic populations of the species, so far as visible differences are concerned, are distinguished principally by the color of the setae of the adults. Specimens from British Columbia south along the Sierra Nevada are uniformly clothed with dark hairs on the dorsal surfaces and on the abdomen. Within this range specimens from the north tend to be more chocolate brown, and from the south darker, almost black. Specimens collected in the Upper Sonoran zone across Northern Arizona have elytra covered with dark, golden-brown hairs with somewhat lighter golden-brown hairs scattered about the basal area of the elytra and on the pronotum. The type of *A. spurcus* LeConte from Santa Fe, New Mexico, is covered with light golden-yellow hairs. A series from Bakersfield, California, resembles the Arizona forms more than those from the higher elevations of the adjacent Sierra Nevada. A short series from Tooele County, Utah, is covered with golden-brown hairs but has a band of lighter golden hairs on the basal margin of the pronotum that makes it very similar in appearance to *A. elongatulus*.

Possibly the color differences between the forms could be described without resorting to subspecific names, except that there appears to be some kind of reproductive barrier between the Arizona forms and those from the Sierra Nevada. Five experiments were conducted to obtain crosses between specimens collected in Sequoia National Park and specimens collected near the eastern edge of the Grand Canyon in Arizona. All resulted in failure. Under identical conditions, as far as these could be regulated, specimens from the original cultures reproduced freely. Unfortunately, specimens from one culture for the most part did not mature at the same time as specimens from the other culture. As a consequence few members of the opposite sex were available from the different cultures for mating and the experiment could not be replicated as many times and under as many different conditions as would have been desirable.

Assuming that the experiments are conclusive in establishing a reproductive barrier between the two populations, two explanations are possible. It might be that an absolute barrier exists and that each population should be considered a distinct species. On the other hand there might be continuous crossbreeding between adjacent

populations and the extremes only might be intersterile. Of course, there is always the possibility that specimens available for crossbreeding happened to be defective in one way or another and were not representative of the populations. Obviously a great deal more study is needed to elucidate the relationships. However, until further evidence is available, it seems best to take a middle ground and designate two subspecies, one including the forms from the Sierra Nevada north to British Columbia and the other including the Arizona and New Mexico forms.

Tentatively the forms from Bakersfield are placed with the Arizona subspecies. Some specimens from Little Granite Mountain, Tooele County, Utah, taken February 3, 1955, as larvae and pupae (D. M. Allred), are not assigned to a subspecies. They seem quite distinct from either of the other two subspecies and probably deserve a separate name. Nevertheless, it would be inadvisable to name them without more extensive collections from the state of Utah.

Whether the nominate subspecies occurs in North America is a question that at present cannot be answered with certainty. Two specimens might be assigned to it, one collected in Atlanta, Georgia, in 1944 by P. W. Fattig and the other labeled simply "Ill." from the Stromberg collection of the Illinois Natural History Survey.

DIAGNOSIS: *A. schaefferi* is obviously more closely related to *A. elongatulus* than to any other Nearctic species. Adults can always be distinguished from *A. elongatulus* by the 10-segmented antenna, but otherwise some forms of the two species are almost impossible to separate. Usually, however, *A. schaefferi* lacks a band of light-colored setae along the base of the pronotum, a character always present in *A. elongatulus*. Larvae of comparable size of the two species can usually be distinguished by the wider tergal and sternal setae of *A. elongatulus*, but a character that will absolutely separate all larval specimens has not been found. The same differences that distinguish *A. elongatulus* from the somewhat similar *A. cyphonoides*, *A. megatoma*, and *A. fasciatus* serve to distinguish *A. schaefferi* from them. These differences are discussed under *A. elongatulus*.

ECOLOGY: The species is apparently a general scavenger on a variety of protein materials. Specimens from Little Granite Mountain, Tooele County, Utah, were taken in a *Neotoma* nest. I collected larvae in an unidentified rodent's nest in a feed storage shed at Sequoia National Park Headquarters, California. Linsley (1944) recorded it in the nests of the English sparrow and the house finch.

He also collected the species in a black phoebe's nest at Fresno, California, where I collected it a few years later. I collected larvae in insect-infested barley and on an old deer hide in a ranch granary 20 miles west of Cameron, Arizona.

To my knowledge the species has not previously been recorded as a pest of stored products. It was taken at Chloride, Arizona, by "L. L. G." in bran and barley, but may have been feeding in grain badly infested with other insects. It seems surprising that it has not been more commonly found as a pest of stored cereals, since I have been able to rear it quite successfully in the laboratory on a diet of oatmeal.

***Attagenus schaefferi hypar*, new subspecies**

Attagenus schaefferi: Casey, 1900, p. 146.—Hatch, 1962, p. 284.

ADULT MALES: Integument dark brown. Dorsal pubescence brownish black; pubescence of abdomen chocolate brown. Ratio of length of terminal antennal segment to combined length of pronotum and elytra 1:4.8. Epipleuron slightly inflated at base becoming slightly concave for most of length.

RANGE OF OBSERVED VARIATIONS: Integument black to dark brown. Dorsal pubescence uniformly black to dark brown. Pubescence of abdomen black to chocolate brown, occasionally with few intermingled dark golden-brown hairs. Ratio of length of terminal antennal segment to combined length of pronotum and elytra varying from 1:4.7 to 1:5.7. Females like males except for much shorter length of antennal club.

PRIMARY TYPES: Holotype male: Fallen Leaf, El Dorado County, California, July 19, 1935 (F. E. Blaisdell); allotype female: Strawberry Valley, El Dorado County, California, August 6, 1912 (Van Dyke Collection). Specimens deposited in the collection of the California Academy of Sciences.

PARATYPES: *British Columbia*: Genoa Bay, Duncan, July 10, 1928 (W. Mathers); Mara Lake, July 20, 1932 (A. C. Thrupp); Midday Valley, Merritt, July 24, 1924 (K. F. Auden); Robson, August, 1949 (H. R. Foxlee); Salmon Arm, May 9, 1936 (D. H. Leech); Salmon Arm, July, 1932 (O. R. Leech); Salmon Arm, July, 1935 (D. H. Leech); Taft, August 2, 1932 (A. C. Thrupp); Trinity Valley, July 1, 10, 11, 12, 1928, July 10, 18, 21, 23, 1929, July 27, 1927, August 18, 1929, August 24, 1930 (J. R. L. Howell); Trinity Valley, July 27, 1927 (E. A. Rendell); Vernon, June 28, 1920 (Ralph Hopping). *California*: Calaveras County: Big Trees,

July 19, 1907 (F. E. Blaisdell). El Dorado County: Fallen Leaf, July 1, 3, 11, 28, 1935 (F. E. Blaisdell); Fallen Leaf, July 10, 1915 (R. Hopping); Kirkwood Lake, July 18, 1946 (A. T. McClay); McKinneys, July, 1906 (Van Dyke Collection); Strawberry Valley, August 5, 1912 (Van Dyke Collection); Tallac, July 7, 1925 (F. E. Blaisdell). Fresno County: Badger Flat, Huntington Lake, August 8, 1939 (A. T. McClay); Bubb's Creek, 8,000 ft. elev., July 29 (Wickham Collection); Bubb's Creek, Kings River, 9,700 ft. elev., July 7, 1910 (Van Dyke Collection); Camp Greeley, 2,800 ft. elev., May 22, 1910 (R. Hopping); Fresno, July 2, 1942; Home Creek, Huntington Lake, July 21, 1936 (A. T. McClay); Huntington Lake, 7,000 ft. elev., July 20, 1919 (F. E. Blaisdell); Huntington Lake, June 21, July 21, 1936, July 22, 1937 (A. T. McClay); Kaiser Pass, Huntington Lake, July 21, 1937 (A. T. McClay); Paradise Valley, Kings River, 7,000 ft. elev., July 17, 1910 (Van Dyke Collection). Inyo County: Independence, May 26, 1919, June 19, 1918 (L. L. Muchmore); Lone Pine, June 18, 1937 (C. A. Hamsher). Lassen County: Blue Lake, July 19–20, 1947 (T. F. Leigh); Butte Creek, July 26, 1948 (A. T. McClay); Facht, July 17, 1921, August 2, 1921 (J. O. Martin); Martin Springs, Sec. 14, T31N, R9E, July 23, 1922 (J. O. Martin); Susan River Camp, July 4, 9, 10, 1949 (A. T. McClay); Susan River Camp, July 10, 1949 (J. E. Gillaspay). Madera County: Biledo Meadow, July 27, 1946 (H. Chandler); Buck Camp, August 1, 3, 1958 (M. E. Irwin); Upper East Fork, Chiquito Creek, August 24, 1958 (M. E. Irwin). Mono County: Cottonwood Creek, July 11, 1961 (J. S. Buckett); Mono Lake, July, 1922 (Coriane Hilton); 7 miles east of Tioga Pass, July 15, 1961 (J. S. Buckett). Modoc County: Buck Creek, July 21, 1922 (C. L. Fox); Cedarville, July 9, 1946 (P. D. Hurd and Ray F. Smith); Warner Mountains, July 10, 11, 1919 (R. Hopping). Nevada County: 3 miles north of Boca, July 23, 1961 (F. D. Parker). Placer County: Brockway, July 2 (George Mansfield); Lake Tahoe, August 21. Plumas County: Meadow Valley, 4,500 to 5,000 ft. elev., June 13, 1924. San Bernardino County: Barton Flats, July 6, 1938 (E. Herald); Camp Baldy, June 14 to 21, 1926 (L. J. Muchmore). Shasta County: Dry Lake, June 24, 1947 (T. F. Leigh); Hat Creek, July 17, 1952 (G. Pronin); Mount Lassen National Park, July 27, 1945, July 28, 1941 (A. T. McClay). Sierra County: Gold Lake, July 8, 1934 (L. S. Ross); Yuba Pass, July 30, 1958 (A. A. Grigarick). Trinity County: Scott Mountain, 5,358 ft. elev., July 14, 1949 (A. T.

McClay). Tulare County: Dorset Creek, August 2, 1917 (R. Hopping); Kern River, 7,000 ft. elev., July 27, 1899; Kern River, 6,000 ft. elev., July 29, 1899; Rattlesnake Creek, July 26, 1917 (R. Hopping); Round Meadow, Giant Forest (Sequoia National Park), August 7, 1903 (R. Hopping); Sequoia National Park, 7,000 to 9,000 ft. elev., July 2, 1929 (A. T. McClay); Park Headquarters, Sequoia National Park, as larvae August 6, 1960 (R. S. Beal). Tuolumne County: Eleanor Lake, July 2, 1951 (S. M. Kappos); Pine Crest, July 3, 1951 (A. T. McClay); Strawberry, June 20, 1951 (S. M. Kappos); Strawberry, June 30, 1951 (R. W. Morgan). Yosemite National Park: Beehive, July 25, 1937 (E. Herald); Boot Trail, July 26, 1936 (A. T. McClay); Givens Creek, August 20, 1958 (M. E. Irwin); Miguel Meadows, 5,300 ft. elev., July 21, 1937 (E. Herald); Yosemite, 3,880 to 4,000 ft. elev., June 7, 1931 (E. O. Essig); Yosemite, 8,000 ft. elev., July 26, 1936 (A. T. McClay); Yosemite Valley, July 12, 1921 (E. C. Van Dyke). *Idaho*: Beaver Canyon (Hubbard and Schwartz). Coola, Priest Lake, July 24, 1927 (E. C. Van Dyke). Bonner County: Sagle, July 2, 1950 (N. M. Downie). Wardner, July 18, 1929 (R. A. Flock). *Nevada*: Gardnerville, 15 miles south, July 21, 1962 (E. J. Montgomery); Lake Tahoe, June 25, 1953 (G. F. Knowlton); Yerington, June, 1909. *Oregon*: Ashland Mountain Road, 4,500 to 5,000 ft. elev., August 10, 1953 (M. C. Lane); Crater Lake National Park, Sun Creek Meadows, 6,500 to 7,000 ft. elev., August 8, 1930 (H. A. Scullen); Crater Lake National Park near Headquarters, 6,400 to 6,600 ft. elev., August 4, 1930 (H. A. Scullen); The Dalles (Wickham Collection); Deming Creek, 11 miles north of Bly (Klamath County), August 12, 1956 (Joe Schuh); Elgin, June 20, 1922 (A. L. Lovett); Klamath Falls, February 18, 1956 (Joe Schuh); Lake of the Woods (Klamath County), July 10, 1934 (Van Dyke Collection); McMinnville, July 26, 1938 (K. M. and D. M. Fender); Medford, August 8, 1946 (A. T. McClay); Mount Ashland, July 18, 1951 (M. F. McClay). *Washington*: Easton (A. Koebele); North Fork Cipsus River (Skamania County), June 25, 1934 (J. L. Wilson); King County, July 14, 1928 (M. H. Hatch); Kooskooskie, Walla Walla, August 1, 1932 (M. C. Lane); Lewis and Clark State Park, June 12, 1938 (M. H. Hatch); Mount Adams, West Klickitat, July 8, 1925 (L. A. Morky); Quilcene, July 27, 1915; Seattle, April 5, 1929; same locality, May 3, 1931 (M. H. Hatch); Sullivan Lake, July 23, 1934 (G. H. and R. Hopping);

Tacoma, May 23, 1948 (N. Fuhr); Vaughn, May 17, 1940 (F. Bjorkmann); Whidby Island, July 30, 1898.

***Attagenus schaefferi spurcus* LeConte, new status**

Attagenus spurcus LeConte, 1854, p. 109.

Attagenus schaefferi: Crotch, 1873, p. 41.

Attagenus piceus: Jayne, 1882, p. 355.

Attagenus cylindricornis: Casey, 1916, p. 183 (see section at end on species described but unrecognized).

ADULT MALES: Integument light brown to dark brown; when elytra light brown, pronotum usually darker. Dorsal pubescence piceous with light golden-brown hairs along lateral and basal margins of pronotum and scattered through basal area of elytra to uniformly light golden-yellow. Ratio of length of terminal antennal segment to combined length of pronotum and elytra varying from 1:4.8 to 1:5.3. Epipleuron flat at base becoming slightly concave along most of length.

TYPE LOCALITY: Santa Fe, New Mexico. Type No. 6868, Museum of Comparative Zoology, Cambridge, Massachusetts.

NEW RECORDS: *Arizona:* Coconino County: Basin Camp, 77 Bar Ranch, 20 miles west of Cameron, as larvae September 27, 1964 (R. S. Beal). Mohave County: Chloride, July 16, 1957 (L. L. G.). Navajo County: Linden, as larvae August 20, 1962 (R. S. Beal). *California:* Bakersfield, April 12, 1944 (E. G. Linsley); Bakersfield, as larvae April 13, 1963 (R. S. Beal).

***Attagenus pello* (Linnaeus)**

Dermestes pello Linnaeus, 1758, p. 355.—Panzer, 1795, p. 96.

Dermestes bipunctatus DeGeer, 1774, p. 197.

Attagenus pello: Latreille, 1807, p. 32.—Dahl, 1823, p. 30.—Stephens, 1830, p. 126.—Kirby, 1837, p. 114.—Laporte, 1840, p. 35.—LeConte, 1854, p. 109.—Wollaston, 1864, pp. 155–156.—Mulsant and Rey, 1867 (1868), pp. 68, 77–80.—Jayne, 1882, p. 355.—Reitter, 1889, p. 557.—Casey, 1900, p. 146.—Ganglbauer, 1904, p. 24.—Lutz, 1911, p. 152.—Wradatsch, 1914, p. 152.—Kempers, 1923, pp. 87–88.—Mutchler and Weiss, 1927, p. 10.—Lepesme and Paulian, 1939, p. 165.—Hinton, 1943, p. 227.—Korschefsky, 1944, p. 147.—Armstrong, 1945, p. 48.—Hinton, 1945, pp. 306–309; 1946, p. 485.—Kalík, 1948, Mroczkowski, 1954, p. 22.—Hatch, 1962, p. 284.—Zhantiev, 1963, p. 421.

Megatoma ater Herbst, 1792, p. 95.

Megatoma schrankii Kugelann, 1792, p. 480.

Megatoma pellio: Illiger, 1798, p. 316.—Brullé, 1832, p. 137.—Reitter, 1887, p. 47.

ADULTS: Adequately described by Hinton (1945).

MATURE LARVAE: Integument of head and dorsum brown. Setae of head dark golden-brown; setae of body consisting of intermingled dark golden-brown narrow hairs and light golden-brown broad hairs.

Head: Antenna with terminal seta subequal to or slightly longer than third segment; no setae present on second segment. Epipharynx with distal series of two sensory pits, each subequal in diameter to sensory pits of middle series. Maxillary palp with two apical setae on penultimate segment. Labium with four to five setae on dorsal (inner) side of each lobe of ligula; medial two setae narrowly ensiform; lateral setae nearly terete; first segment of palp without setae.

Body setae: Margins and ribs uniformly smooth. Setae inserted on acrotergite of first abdominal segment consisting of linear and broadly lanceolate hairs; widest lanceolate hairs with three to six ribs between margins (Fig. 21); broad setae becoming increasingly wide on acrotergites of succeeding segments; broad setae on acrotergites of posterior segments with as many as twelve ribs between margins. Disc of tergite of first abdominal segment with intermingled linear-lanceolate setae with two or three ribs between margins and ovate to subquadrate setae with as many as six ribs between margins; setae of succeeding tergites similar except scale-like setae becoming more rectangular although retaining acutely produced apices; scale-like setae on eighth segment with six to 14 ribs between margins (Fig. 22). Sockets of submarginal erect setae with two sensory pits, one on either side near anterior margin. First abdominal sternum with setae along midline longer than other setae of disc. Setae of sternum of eighth abdominal segment identical with setae of tergite.

Spiracle and associated structures: Anterior abdominal segments with spiracle closed behind by tergum; anterior margin of spiracle projecting ventrad over posterior margin and bearing acute denticle (Fig. 25); spiracle adjacent to spiracular sclerite. Spiracular sclerite irregularly oval, not enclosed by tergum. Tergum sclerotized continuously with tergal margin of spiracular sclerite.

Abdomen: Eighth abdominal tergum with well-defined antecostal suture. Ninth abdominal tergum about one-half as long as

tergite of eighth abdominal segment. Two small sclerites present in sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg about 8/17 as wide as long; ventral margin about 4/11 as long as length of segment. Tibia of prothoracic leg with usual two rows of ventral setae; posterior face with subdorsal apical seta and longitudinal row of four seta along middle of segment; most proximal seta of row inserted at about basal third of segment. Setae inserted at base of pretarsus subequal in width and extending about as far as middle of claw.

RECORDED DISTRIBUTION: Widespread throughout Palearctic Region; in North America in Nova Scotia, New Hampshire, Massachusetts, Michigan, New Jersey, New York, Rhode Island, British Columbia.

NEW RECORD: Rockhaven, Kentucky (H. Soltau).

DIAGNOSIS: Adults are easily recognized by the two small patches of white or light golden-yellow hairs on the middle of the elytra near the suture. These contrast sharply with the dark brown to black hairs covering most of the dorsal surface. The male antennal club has the first two segments short and subequal. The terminal segment is four to five times as long as the combined length of the first two.

The larvae are dark golden-brown. They may be distinguished from all other species described here by the smoothly margined, more or less rectangular setae inserted on the posterior abdominal terga and sterna. On the eighth abdominal segment these scale-like setae have six to 14 ribs between the margins. Setae of the anterior segments are ovate to subquadrate. All other species with scale-like setae have ovate or ovate-lanceolate setae, and the setae have denticulate instead of smooth margins.

ECOLOGY: Larvae of this species, like larvae of most other species of the genus, appear to be general scavengers on dried protein materials. Out-of-doors they are commonly found in swallow nests, where they feed on feathers and the remains of other insects (Hinton, 1945). In England Woodroffe (1953) found them to be regular inhabitants of dry bird nests, particularly of pigeon nests and of jackdaw nests in hollow trees. Hicks (1959) has collected numerous additional references to the occurrence of the species in bird nests, which include, in addition to those above, nests of the house martin, swift, owl, English sparrow, titmouse, flycatcher, and white wagtail.

Hinton (1945) summarizes the reported occurrences of this

species as an economic pest, listing the following products on which it has been found, presumably feeding: furs, skins, woolens, carpets, grain, flour, maize, meal, cattle food, rye bran, and sugar. Whether it can mature feeding on cereal products alone has not been determined. Probably it maintains itself in cereal products, at least to some extent, on the remains of other insects. It also attacks dried insects in museums.

R. W. Howe (1962) states that the species shows diapause, but the factors that initiate it are unknown.

PARASITES: The larvae have been found parasitized by the gregarine, *Pyxinia mobuszi* Leger and Duboscq (Foerster, 1938, Eichler, 1939), a parasite also found in *Anthrenus verbasci* (Linnaeus).

***Attagenus fasciatus* (Thunberg)**

Anthrenus fasciatus Thunberg, 1795, p. 105.

Anthrenus gloriosae Fabricius, 1798, p. 76.—Fabricius, 1801, p. 107.

Dermestes fasciatus: Schönherr, 1808, p. 88.

Attagenus fasciatus: Dejean, 1837, p. 139.—Mroczkowski, 1964, pp. 179–180.

Attagenus annulifer Laporte, 1840, p. 36.

Attagenus gloriosae: Lacordaire, 1854, p. 464.

Aethriostoma gloriosae: Motschulsky, 1858, p. 146.

Trogoderma subfasciatum Chevrolat, 1863, p. 617.

Attagenus plebeius Sharp, 1885, p. 47.

Attagenus gossypii Fauvel, 1903, p. 335.

Attagenus gloriosae: Arrow, 1915, p. 427.—Hinton, 1943, p. 224; 1945, pp. 320–322.—Armstrong, 1945, p. 48.—Hinton, 1946, p. 19.—Kalík, 1955, pp. 307–308.

ADULTS: Adequately described by Hinton (1945) under the name *A. gloriosae*.

MATURE LARVAE: Dorsal integument reddish-brown. Setae on dorsal and ventral surfaces dark golden-brown except for light golden-brown setae on legs.

Head: Antenna with terminal seta one and one-eighth times as long as terminal segment; second segment bearing 12 or more setae. (Epipharynx not observed.) Maxillary palp with two setae on third segment. Labium with series of two medial lanceolate setae and three or four slender ensiform lateral setae on dorsal (inner) side of each lobe of ligula; first segment of palp without seta.

Body setae: Margins and ribs uniformly smooth. Acrotergites with some linear setae with one rib between margins and some simple

setae. Tergites with linear setae with two to five ribs present between margins. Sockets of submarginal erect setae usually with two adjacent sensory pits, one on each side. Sterna with linear setae; setae of disc with two ribs between margins; setae smaller and without ribs on anterior area of each sternum; anterior margin without row of stouter, longer setae; setae at midline of first two abdominal sterna not appreciably longer than other sternal setae.

Spiracle and associated structures: Spiracle closed behind by tergum; anterior margin of spiracle slightly curved; width of spiracle less than one-third width of spiracular sclerite; spiracle removed from spiracular sclerite by distance equal to about two-thirds its width. Spiracular sclerite oval, bearing six or fewer setae, not enclosed by tergum; area of tergum in front of spiracular sclerite well sclerotized and continuous with tergal margin overlying anterior margin of spiracular sclerite.

Abdomen: Eighth abdominal tergum with antecostal suture. Ninth abdominal tergum about five-ninths as long as tergite of eighth segment. Two small sclerites present in sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg half as wide as long; ventral margin little less than half as long as length of segment. Tibia of prothoracic leg as illustrated (Fig. 27). Pretarsus with setae narrowly ensiform, subequal in width and length.

DISTRIBUTION: The species occurs nearly throughout the tropical and subtropical areas of the world. In the continental United States it is apparently established only in Florida, although it has been taken infesting stored products in Buffalo, New York, and Indianapolis, Indiana. Records for the species in Florida are the following: Deland, April 21, 1960 (G. W. Desin); Miami, March 3 and April 14, 1960 (E. M. Collins); Orlando, May 27, 1935, July 10, 1935, December 1, 1936; Tampa, May 20, 1960 (E. M. Collins, Jr.).

DIAGNOSIS: Adults are immediately distinguished from all other Nearctic species by the distinct subbasal elytral band of light golden hairs. The remainder of the elytra is covered with brownish black hairs, which contrast sharply with the color of the elytral band. Usually the band is fairly broad and extends from the lateral margin of each elytron to the median suture. At the median suture it is narrower and projects a little basad. Rarely the band is discontinuous, but when it is there is always a distinct spot of light-colored hairs on the median suture posterior to the scutellum. Any other species

of *Attagenus* or *Novelsis* in the United States that has a distinct subbasal elytral band also has a light-colored line along the entire basal three-fourths of the median suture, or has more than one elytral band, or the subbasal band does not extend to the median suture and there is no distinct spot of light-colored hairs on the suture just posterior to the scutellum. A number of other differences seem to make this species unique among the Nearctic *Attagenini*, one of which is the short terminal segment of the male antennal club. Males of the species cannot be distinguished from the females unless the genitalia are exposed. It is also relatively broader than other Nearctic species, has stouter front coxae, and stouter femora. Because of these traits it was placed in the genus *Aethriostoma* by Motschulsky. Nevertheless, larval characters show it to be much more closely allied to *Attagenus* and to the cluster of species designated Group I.

The larvae are quite similar to larvae of *A. megatoma*. The one distinctive character that separates them from larvae of *A. megatoma*, as well as from larvae of all other Nearctic species, is the number of setae on the second segment of the antenna. Twelve or more are present on this segment in mature specimens. Mature larvae of *A. megatoma* lack setae on the second segment, and no other species I have studied has more than three setae on the segment.

ECOLOGY AND LIFE HISTORY: Hinton (1945) has collected and published information on these aspects of the species. If there is additional published information, I am unaware of it. In addition to those products which it has been recorded as infesting, it was found in dried buttermilk in Buffalo, New York (L. F. Hoyt) and in crude drugs in Indianapolis, Indiana (J. J. Favinger). The species also has been intercepted at Tampa, Florida, in *Caesalpinia coriaria* imported from Columbia.

***Attagenus bicolor* Harold**

Attagenus dichrous LeConte, 1854 (*non dichrous* Roth, 1851), p. 110.

Attagenus bicolor Harold, 1868, p. 104.—Reitter, 1880 (1881), p. 34.

Attagenus piceus: Jayne, 1882, p. 355.

Attagenus schaefferi: Dalla Torre, 1911, p. 57.

Attagenus sparsus Casey, 1916, p. 184 (New synonymy).

ADULT MALES: Integument of dorsal and ventral surfaces immaculate; head dark brown to black; pronotum reddish brown to dark brown; elytra reddish brown; venter reddish brown to dark brown; legs and antennae yellowish to reddish brown; terminal seg-

ment of club not darker than preceding segments of club. Pubescence of head and dorsal surfaces subrecumbent to suberect; pubescence of ventral surfaces subrecumbent; all hairs black or hairs black on dorsum and reddish brown on venter and legs. Head with eye entire. Antenna 11-segmented; ratio of combined length of first two segments of club to length of terminal segment varying from 1:3.6 to 1:5.2; ratio of length of terminal segment to length of pronotum and elytra combined varying from 1:6.7 to 1:8.8; club clothed with very fine subrecumbent hairs less than one-fourth as long as width of third antennal segment; hairs slightly longer at apex of terminal segment. Channel below eye for reception of flagellar shaft of antenna concave with anterior margin forming carina visible from front of head (Fig. 1); carina projecting knife-like beneath head, curved very little behind base of maxilla and not meeting gular suture. Pronotum with lateral carina continued around anterolateral angle; basal lobe feebly rounded to slightly truncate and not distinctly produced backward; setae on posterior margin of lobe subequal in length to other setae of pronotum. Punctures of pronotal disc varying in width from two-thirds as wide to equal to width of facet of eye and separated by two to five diameters of single puncture. Elytron with hairs of disc about as long as combined length of antennal segments three through seven. Hypomeron nearly flat at middle, sometimes slightly concave toward base; without auricle-like lobe covering trochantin so that trochantin fully exposed (Fig. 7). Prosteronum with posterior margin of lateral lobe flat and not reflected against middle of coxa but reflected against lateral part of coxa and against trochantin; reflected part short, about one-third as long as length of horizontal part of lateral edge of lobe; anterior margin of prosteronum with distinct thread-like lateral carina but without denticle at middle of anterior margin; posterior process scarcely wider at apex than between coxa and without median carina extending onto disc. Epipleuron terminating at or little before hind margin of metepimeron. Ventral plate of hind coxa not forming distinct tooth lateral to insertion of trochanter but becoming gradually narrower laterally; plate terminating laterally behind metepisternum at inner margin of metepimeron (appearing to meet metepimeron behind metepisternum) (Fig. 6). Protibia not carinate on dorsal margin. Mesofemur with anteroventral and posteroventral margins of crural cavity about equally produced and on same plane. Length (of pronotum and elytra combined): 3.8 mm. to 4.4 mm.

ADULT FEMALES: Antennal club with terminal segment one and one-fifth to one and one-fourth times as long as length of ninth and tenth segments combined; tenth segment equal in length to ninth segment. Length (of pronotum and elytra combined): 4.9 mm. to 5.3 mm. (based on reared specimens alone).

MATURE LARVAE: Dorsal integument brown. Setae of head golden-brown; setae of body black except for few dark golden-brown hairs on nota intermingled with black hairs; setae of ventral thoracic segments and legs golden-brown; setae of ventral abdominal segments black; terminal abdominal setae dark brown and black.

Head: Antenna with terminal seta subequal in length to third segment; no setae present on second segment. Epipharynx with distal series of two sensory pits, each subequal in diameter to sensory pits of middle series. Maxillary palp with three setae on penultimate segment. Labium with four to six setae on dorsal (inner) side of each lobe of ligula; medial two setae narrowly ensiform; lateral setae nearly terete; first segment of palp with two setae.

Body setae: Very minutely serrulate along ribs (serrulations visible only under high power of compound microscope). Setae inserted on acrotergites all more or less terete and linear, with as many as six ribs distinguishable between margins (ribs visible only in specimens treated to remove pigments from setae and then difficult to demonstrate except under oil immersion lens). Disc of tergite with setae similar to those on acrotergite but with as many as eight ribs distinguishable between margins of larger setae. Three submarginal erect setae on each side of each abdominal segment; sockets usually with one adjacent sensory pit on either medial or lateral side but rarely with two adjacent sensory pits, one on each side. First abdominal sternum with few setae somewhat longer than other setae of disc. Eighth abdominal sternum with setae nearly identical to setae of tergum; setae becoming smaller anteriorly without row of longer, stouter setae near anterior margin of segment.

Spiracle and associated structures: Abdominal segments with spiracle enclosed by tergum; anterior abdominal segments with distance from posterior margin of tergite to spiracle about one-fifth length of tergite; anterior margin of spiracle more or less straight; posterior margin somewhat thickened; spiracle separated from spiracular sclerite by distance about equal to width of trachea entering spiracle (Fig. 14). Spiracular sclerite oval, completely enclosed by tergum; three setae inserted on sclerite of each segment.

Abdomen: Eighth abdominal segment without antecostal suture

on tergum. Ninth abdominal tergum about five-sevenths as long as eighth abdominal tergum. Two small sclerites present within sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg about half as wide as long; ventral margin about half as long as length of segment. Setae inserted at base of pretarsus subequal in width and extending to about apical third of claw.

TYPE LOCALITIES: The type locality for *A. dichrous* is New Mexico (type specimen No. 6870 in the Museum of Comparative Zoology, Cambridge, Massachusetts). The type locality for *A. sparsus* is Jemez Springs, New Mexico (holotype in the Casey Collection, United States National Museum).

NEW RECORDS: *Arizona:* North Rim of the Grand Canyon, 8,150 ft. elev., as larvae August 30, 1964 (R. S. Beal). *Colorado:* Colorado Springs, 6–7,000 ft. elev., June 15–30, 1896 (H. F. Wickham); Rico, May 22, 1950 (Hopkins U. S. No. 34216-W). *New Mexico:* Fort Wingate (J. D. Sherman); Jemez Mountains, June 11, 22, 27, July 3 (John Woodgate); Santa Fe (Boyle). *Nevada:* Baker, Sec. 15, T13N, R69E. Mt. Diablo Meridian, May 23, 1939 (T. O. Thatcher). *Utah:* Callao, June 2, 1922 (specimen in the Casey Collection at the United States National Museum standing under the name *elongatulus*); Circleville, June 27, 1933 (G. F. Knowlton); South Creek, Beaver County, June 22. *Wyoming:* Cokeville, April 20, 1952 (William May).

Dead larvae and adults have also been found in matted vegetation and fill in the Mesa Verde Ruins in southwestern Colorado. Although the adults were badly fragmented, enough remained for positive identification. The larvae that were found were surprisingly well-preserved, with most of the setae intact. They had apparently died in ecdysis, a phenomenon often associated with starvation. All were recovered in Site No. 1285 (S. A. Graham).

DIAGNOSIS: *A. bicolor* and the allied *N. athlophora* are readily distinguished from all other Nearctic Attagenini by a number of characters. The most noticeable distinguishing feature is the long, sparse, completely black pubescence of each. Almost all other members of the tribe have light golden-brown or whitish ventral pubescence, and many have light-colored dorsal hairs. *A. schaefferi hypar* has predominately chocolate-colored or blackish ventral setae, but it does have at least a few golden-brown hairs on the front coxae, the setae are moderately dense and short, the dorsal setae are subrecumbent, and the ventral setae are recumbent. *A. bicolor* and

N. athlophora also share the following combination of characters not found in other species treated here: the hind coxa lacks a definite tooth lateral to the insertion of the trochanter and is wider at the base of the trochanter than at any point lateral to it; the epipleuron terminates at about the hind margin of the metepimeron; the hypomeron is more or less flat or very slightly concave; the lateral lobe of the prosternum is somewhat longitudinally concave and reflected ventrad in front of the trochantin but lies mostly in a horizontal plane and is not reflected in front of the middle of the procoxa.

Both males and females of *A. bicolor* are separable from *N. athlophora* by the number of segments in the antenna: *A. bicolor* has 11 and *N. athlophora* 10 segments. The male antennal club of *A. bicolor* is that of a typical *Attagenus*. The terminal segment is about five times as long as the two preceding segments combined. The male antennal club of *N. athlophora* has all segments elongated so that the terminal segment is no more than four-fifths as long as the two preceding combined. The dorsal integument of *A. bicolor* is a medium reddish brown with the pronotum and head often a dark brown. The known specimens of *N. athlophora* are a very dark brown, except that one has a light brown sutural line.

The larvae of *A. bicolor* are relatively sparsely clothed with linear black hairs. They are easily distinguished from other larval Attagenini by the nearly completely enclosed spiracular sclerite and the remarkable position of the spiracle, which is some distance from the posterior margin of the tergum. Only *N. varicolor* has a similarly enclosed sclerite with the spiracle so remotely separated from the posterior margin of the tergum. However, *N. varicolor* is densely covered with ovate setae, which obscure the structures so that they cannot be seen without first teasing the setae away. Possibly *N. athlophora* will prove to have similar larval structures, but at present the immature stages of this species are unknown.

ECOLOGY: I collected numerous larvae of this species in an insect-infested mixture of grain and straw in an unidentified rodent's nest (probably chipmunk) in a small granary at the North Rim of the Grand Canyon of Arizona. Adults breed in the laboratory without the necessity of flying or of feeding on nectar or pollen. Larvae mature to adults on dried dog food or on oatmeal, as well as on grain trash. Adults emerged in the laboratory in summer, fall, and winter months and have been collected in the field in April, May, and June, suggesting that emergence is not controlled by

photoperiodicity. Further study might reveal some interesting differences in the physiological responses of this and other members of the tribe.

Novelsis athlophora Beal

Novelsis athlophora Beal, 1954, pp. 81, 89.

ADULTS: Male described by Beal (1954).

MATURE LARVAE: Unknown.

TYPE: Type locality: Beaver Canyon, Idaho. Holotype in the collection of the United States National Museum. No other localities recorded in description.

NEW RECORDS: *British Columbia*: Aspen Grove, June 17, 1931 (H. Richmond); Midday Valley, Merritt, June 4, 1924 (K. F. Auden). *Idaho*: Rocky Point, Benewah County. *Washington*: Dayton, July (L. Turner).

DIAGNOSIS: This is a dark brown species sparsely clothed with long, suberect, black hairs. There are no golden-brown or other light-colored hairs on the dorsal or ventral surfaces. Both male and female antennae are 10-segmented, a character that distinguishes the species from all other Nearctic species with uniformly dark dorsal pubescence, except *A. schaefferi*. The shape of the antennal club of the male, in which the length of the first two segments combined exceeds the length of the terminal segment by at least a fourth, separates the species from *A. schaefferi*, as also does the long, sparse setae of the body.

Attagenus lobatus Rosenhauer

Attagenus lobatus Rosenhauer, 1856, p. 108.—Jacquelin du Val, 1859, p. 254.—Mulsant and Rey, 1868, pp. 100–101.—Hinton, 1945, pp. 323–324.—Zhantiev, 1963b, p. 415.

Attagenus byturoides Solsky, 1876, pp. 272–273.—Reitter, 1889, p. 557.—Solodovnikova, 1938, pp. 1–20.

Attagenus sericeus Reitter, 1880 (1881) (*non sericeus* Guérin, 1829), p. 79.—Reitter, 1887, p. 51.

ADULTS: Adequately described by Hinton (1945). Adult head shown in Figure 2; dorsal outline in Figure 8.

MATURE LARVAE: Dorsal integument light brownish yellow. Setae uniformly light golden-brown.

Head: Antenna with terminal seta about twice as long as length of terminal segment; no setae present on second segment. Epipharynx with distal series of two sensory pits, each slightly larger in diameter than diameter of sensory pits of middle series.

Maxillary palp with two setae on penultimate segment. Labium with about four ensiform and four slender setae on dorsal (inner) side of each lobe of ligula; palp without seta on first segment.

Body setae: Margins and ribs uniformly smooth. Setae inserted on acrotergites about half as long as length of tergum or longer and gradually becoming extremely fine (almost beyond point of resolution except with oil-immersion lens); proximal part of shaft with very fine ribs (also difficult to observe except with high magnification). Setae on tergites consisting of linear marginal and submarginal hairs and of lanceolate hairs with five to seven ribs between margins; only lanceolate setae present on disc of tergite. Submarginal setae suberect, inserted nearly at same level as marginal setae. Sockets of submarginal, suberect setae usually with two adjacent sensory pits. Sterna with lanceolate setae only on disc; lanceolate setae with seven to eight ribs between margins; anterior margin of each sternum with row of stout linear setae one to two times as long as lanceolate setae; numerous fine, long, linear, simple setae inserted anterior to row of stout setae.

Spiracle and associated structures: Spiracle closed behind by tergum; anterior margin of spiracle more or less straight; spiracle adjacent to spiracular sclerite. Spiracular sclerite elongate-oval, bearing eight to 10 or more setae, closed behind by narrow margin of tergum, but often not appearing so, since spiracular sclerite may overlap margin; area of tergum in front of spiracular sclerite well-sclerotized and continuous with tergal margin overlying anterior edge of sclerite (Fig. 15).

Abdomen: Eighth abdominal tergum with antecostal suture. Ninth abdominal tergum about half as long as tergite of eighth abdominal segment. Two small sclerites present in sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg about three-sevenths as wide as long; ventral margin about two-thirds as long as length of segment. Tibia and pretarsus as illustrated (Fig. 28); setae at base of pretarsus slender, subequal in width and length.

DISTRIBUTION: The Palearctic distribution extends from Spain to Mongolia including Bulgaria and Uzbek, U.S.S.R., on the north and Tunisia, Egypt, Arabia, and Afghanistan on the south (Mroczkowski, 1968). It is apparently established in the cities of Detroit, Michigan (February 2, 1960; J. G. Hunter) and New York, New York (May 15, 1964; Jack Lipes).

DIAGNOSIS: Adults of *A. lobatus* are uniformly clothed with

golden-brown pubescence. The pubescence is quite short except for noticeably longer tufts of hairs on the margin of the basal lobe and each lateroposterior angle of the pronotum. The integument of the elytra is reddish brown. The integument of the pronotum is similarly colored, or at most only a little darker. The most distinctive character of the adults and one that immediately distinguishes it from all other Nearctic species is the elongated and truncated basal lobe of the pronotum (Fig. 8). The species is also unique among Nearctic forms in possessing a carina along the dorsal margin of the front tibia. The antenna is 11-segmented. The form of the antennal club is somewhat similar to that of *N. uteana*, with the terminal segment subequal in length to the combined length of the first two segments.

Superficially the adults resemble some females of *N. uteana* more than any other Nearctic species. However, the dorsal pubescence of *N. uteana* is definitely lighter in color, the pronotal integument is brownish black and contrasts sharply with the reddish yellow elytral integument, the dorsal hairs are much longer, particularly along the margins of the pronotum and elytra where many hairs are as long as the width of the eyes, the front tibia lacks a dorsal carina, and the antenna is 10-segmented.

Mature and semi-mature larvae are easily distinguished from all other known larval forms by the fact that there are no linear or linear-lanceolate setae intermingled with the broad lanceolate setae of the sterna. *A. elongatulus*, *A. schaefferi*, and *A. pellio* have similarly broad sternal setae, but each has linear setae inserted among the lanceolate setae, at least on the sides of each sternum. *N. varicolor* and *N. aequalis* both have lanceolate setae with as many ribs as are found in the setae of *A. lobatus*, but the margins of the setae and the ribs are strongly serrulate or denticulate and do not at all resemble the smoothly margined setae of *A. lobatus*. A further distinguishing character is the presence of a row of moderately stout linear setae inserted on each sternum in front of the lanceolate setae. The linear setae are longer than the lanceolate setae. Anterior to these a number of fine simple setae is inserted on each sternum. No other Nearctic species has a row of stout linear setae near the anterior margin of each sternum. In other species the sternal setae become gradually smaller toward the anterior end of the segment. The larvae of *A. lobatus* are also unique in that the spiracular sclerite bears eight to ten or more setae instead of six or fewer.

ECOLOGY: Zhantiev (1963a) found this species in nests of

desert owls (*Athene noctua bactriana* Hutt.), Old World jumping rats or gerbils (Gerbillinae), long-clawed ground squirrels (*Spermophilopsis leptodactylus* Licht.), and various predatory mammals such as foxes and badgers in sandy and clayey desert regions of Turkmenia and Tadzhikistan in the U.S.S.R. He observed there is a tendency for this species to select nests of desert owls found at the base of cliffs, while other species of Dermestidae more commonly occupy nests constructed in crevices higher on the cliffs and still different species occupy nests in sandy holes.

Hinton (1945) summarizes reported occurrences of this species as an economic pest, listing the following products on which it feeds or in which it has been found: skins, furs, feathers, woolen goods, museum specimens, grain and refuse in granaries, and red pepper. In the United States the species has been found in buildings. Larvae were reported by J. G. Hunter to bite the skin of humans and the bites were followed by a slight itching.

***Novelsis perplexa* (Jayne)**

Attagenus perplexus Jayne, 1882, p. 35.

Novelsis perplexa: Casey, 1900, p. 194.—Beal, 1954, p. 77.—Hatch, 1962, p. 284.

ADULTS: Redescribed by Beal (1954). Other stages remain unknown.

RECORDED DISTRIBUTION: The type locality is Nevada. Other records include scattered localities from Southern California north to British Columbia.

ADDITIONAL RECORDS: *British Columbia*: Vernon, August 2, 1929 (R. Hopping). *California*: Fresno County: Tollhouse, June 30, 1961 (C. D. Johnson). Madera County: North Fork, July 19, 1963 (C. D. Johnson). Nevada County: 3 miles north of Boca, September 4, 1960 (F. D. Parker). Plumas County: Meadow Valley, July 22, 1961 (T. Gantenbein). Riverside County: San Jacinto Mountain Trail, July 1, 1952 (J. F. Powers). San Diego County: Mount Palomar, June 21, 1959 (M. E. Irwin). Tulare County: Kern River, 6,000 ft. elev., July 29, 1899 (probably L. L. Muchmore). Yolo County: Winters, August, 1961 (J. L. Campbell). *Idaho*: Krassel Ranger Station, Martin Creek, July 26, 1956 (S. Stevens). *Oregon*: Klamath County: Bly, July 20, 1956 (M. Wasbauer); Swan Lake, August 8, 1953 (Joe Schuh).

TAXONOMIC POSITION: Judging by similarities of adult characters, this species is closely related to *N. varicolor* and *N. aequalis*. The allopatric pattern of distribution of the three species further

suggests their relatively recent divergence from a common origin. Whether a mechanism for reproductive isolation exists between the forms is a question that remains unanswered.

DIAGNOSIS: The following characters are common to adults of *N. perplexa*, *N. varicolor*, and *N. aequalis*. The dorsal pubescence consists of black, golden-brown, and white hairs. The light-colored hairs form a thin basal band or basal patches, a semicircular subbasal band, an irregular and often interrupted submedian band, and an irregular subapical band or patch. The hairs are subrecumbent on the disc but suberect on the lateral margins. The hairs are also much longer than for most other Attagenini, the longest being longer than the scutellum, giving the specimens a somewhat shaggy appearance. The segments of the male antennal club are densely clothed with very fine, erect pubescence with the individual hairs about two-thirds as long as the width of the third segment of the antenna.

N. perplexa may be distinguished from *N. varicolor* and *N. aequalis* by the following characters. The antenna is 10-segmented. The first two segments of the male antennal club combined are about one-sixth longer than the terminal segment. The other two species have an 11-segmented club and the first two segments of the male club combined are about one-third longer than the terminal segment. The elytral integument of *N. perplexa* is entirely black or black with reddish maculae corresponding in pattern to the areas of light pubescence. *N. aequalis* may rarely have the elytral integument entirely black, but ordinarily it has a suffused reddish macula near the middle of the elytra. *N. varicolor* has yellowish brown maculae that may correspond to areas of light-colored pubescence or that may coalesce to varying degrees. Occasionally each elytron may have one large yellowish macula that extends over the entire elytron except for the black margins.

ECOLOGY: Virtually nothing is known of the ecology of the species. Adults have been collected at light and on flowers of yarrow (*Achillea*) and milkweed (*Asclepias*). An adult has also been collected on Douglas-fir (*Pseudotsuga Menziesii* (Mirb.) Franco).

Novelsis varicolor (Jayne)

Attagenus varicolor Jayne, 1882, p. 357.

Novelsis varicolor: Casey, 1900, p. 149.—Beal, 1954, pp. 78–80.

ADULTS: Redescribed by Beal (1954).

MATURE LARVAE: Dorsal integument brown. Setae of head and dorsal surfaces brownish black; setae of ventral surfaces chocolate brown.

Head: Antenna with terminal seta five-ninths as long as length of terminal segment; no setae present on second segment. Epipharynx with distal series of two sensory pits, each with diameter about half diameter of sensory pits of middle series. Maxillary palp with nine to 14 setae inserted on third segment. Labium with six setae on dorsal (inner) side of each lobe of ligula; medial two setae narrowly ensiform with lateral setae becoming nearly terete; first segment of palp without seta.

Body setae: Margins and ribs serrulate to denticulate. Acrotergites of anterior abdominal segments with lanceolate and ovate-lanceolate setae with three to six ribs between margins (Fig. 17). Disc of tergites with setae regularly or irregularly ovate with acute to obtuse apices and with as many as 11 to 13 ribs between margins (Fig. 19). Sockets of submarginal erect setae with two adjacent sensory pits, one on each side. Setae of sterna lanceolate and ovate-lanceolate with elongated apices. First abdominal sternum with setae at midline not appreciably longer than other setae of disc. Eighth abdominal sternum with broadest setae having six to eight ribs between margins; setae becoming slightly smaller toward anterior margin of sternum without row of longer linear setae.

Spiracle and associated structures: Spiracle enclosed by tergum; anterior margin more or less straight and usually projecting over posterior margin; distance between spiracle and spiracular sclerite roughly equal to width of trachea (Fig. 13). Spiracular sclerite nearly round, enclosed by tergum; tergum on lateroposterior side of sclerite reduced to narrow margin.

Abdomen: Eighth abdominal tergum without antecostal suture. Ninth abdominal tergum about two-sevenths as long as eighth abdominal tergum. Two small sclerites present in sternum of ninth abdominal segment.

Legs: (Ratio of length to width of femur not observed); tibia of prothoracic leg with usual two rows of stout ventral setae; posterior face with stout subdorsal apical seta and submedian group of irregularly arranged four or five stout setae and several slender setae. Pretarsus with posterior seta inserted at base about twice as wide as anterior seta.

DISTRIBUTION: Previously described (Beal, 1954) as extending from El Centro, California, to Presidio, Texas; on the south from

Carr Canyon in the Huachucha Mountains, Arizona, north to Hoover Dam and to Globe, Arizona. New records outside this range are the following: *Arizona*: Sedona, Coconino County, June 20, 1964 (R. S. Beal). *California*: Indian Wells, Riverside County, April 19, 1961 (G. H. Nelson); Mitchell's Cavern, San Bernardino County, April 16, 1962 (G. H. Nelson). *Sonora, Mexico*: Masiaca Huatabampo, May 28, 1955 (F. Pacheco M.).

DIAGNOSIS: The following characters distinguish adults of *N. varicolor* from those of *N. perplexa* and *N. aequalis*. The integument of the elytra is black or piceous and marked with yellowish tan or yellowish brown maculae. The maculae rarely correspond in extent to the subbasal, submedian, and subapical areas of light pubescence, but commonly the subbasal and submedian maculae coalesce to form one spot. At times there is a single large macula that occupies the entire elytron except for a narrow margin of black. The pubescence is always tricolorous, although the light-colored hairs are predominately white and the golden-yellow hairs may be limited to a few near the margins of the bands of light-colored pubescence. The species may be distinguished definitely from *N. perplexa* by its 11-segmented rather than 10-segmented antenna.

Characters that adults of this species have in common with *N. perplexa* and *N. aequalis* and that distinguish them as a group from other groups within the tribe are discussed under the diagnosis of *N. perplexa*.

Larval characters shared by this species and *N. aequalis* are listed under Relationships, Group IV. Characters distinguishing larvae of *N. varicolor* and *N. aequalis* are discussed under the diagnosis of the latter.

ECOLOGY: Larvae have been found in *Sceliphron* mud dauber nests (Beal, 1951), in pigeon droppings, in hens' nests, in nests of English sparrows, in a cactus wren's nest, and in the nest of an unidentified spider in a chicken house. I collected the species in Tucson, Arizona, in moderate numbers from sacks of feed in a granary. The feed was infested with a number of other insects, and it was probably feeding on their dead remains rather than on the grain. It was also collected by Gus A. Amado in a seed and feed mill in Nogales, Arizona. I have reared the species through several generations on dried dog food. Adults have been collected on mesquite [*Prosopis juliflora* (Swartz) DC.] and on catclaw (*Acacia greggii* A. Gray).

At room temperatures the species matures in a year. Out-of-doors adults appear from May through July. In the laboratory adults

may emerge as early as February and March but not after June. This pattern suggests that emergence is governed by photoperiodicity but may be accelerated by warm temperatures.

***Novelsis aequalis* (Sharp)**

Genattus aequalis Sharp, 1902, p. 646.

Attagenus aequalis: Hinton, 1945, p. 306.

Novelsis aequalis: Beal, 1954, p. 80.

ADULTS: Redescribed by Beal (1954).

MATURE LARVAE: Dorsal integument brown. Setae of all surfaces black except for some golden hairs on legs.

Head: Antenna with terminal seta subequal in length to length of terminal segment; one or no seta present on second segment. Epipharynx with distal series of two sensory pits, each with diameter about half diameter of sensory pits of middle series. Maxillary palp with two setae inserted on third segment. Labium with six setae on dorsal (inner) side of each lobe of ligula; medial four or five setae narrowly ensiform; lateral one or two setae terete; first segment of labial palp without seta.

Body setae: Margins and ribs serrulate to denticulate. Acrotergites of anterior abdominal segments with linear and ovate-lanceolate setae; largest setae with 10 to 11 ribs between margins. Tergites with linear and irregularly rounding to ovate setae on disc; rounding and ovate setae terminating in single acute apex or two acute apices with as many as 15 to 16 ribs between margins of widest setae (Fig. 23); setae on posterior margins broadly linear with acute apices and eight to 10 ribs present between margins on dorsal side and 16 to 22 ribs present between margins on ventral side. Sockets of submarginal erect setae with two adjacent sensory pits, one on either side. Sterna with linear and linear-lanceolate setae; linear-lanceolate setae with as many as nine ribs present between margins; setae becoming smaller toward anterior margin of each sternum; setae on midline of first abdominal sternum longer than other setae of disc.

Spiracle and associated structures: Spiracle closed behind by tergum, removed from spiracular sclerite by distance equal to about half width of spiracle; opening simple, somewhat oval. Spiracular sclerite rhomboidal to ovate, encircled by rim-like extension of sclerotized part of tergum; area of tergum immediately anterior to front margin of rim unsclerotized; entire structure appearing to project peninsula-like from posterolateral margin of tergum (Fig. 24).

Abdomen: Eighth abdominal tergum with antecostal suture. Ninth abdominal tergum about one-third as long as tergite of eighth abdominal segment.

Legs: Femur of prothoracic leg about 10/17 as wide as long; ventral margin about 8/17 as long as length of segment. Posterior face of front tibia with stout subdorsal apical seta and subventral row of four stout setae a little above ventral two rows of stout setae; most proximal stout seta at about basal two-fifths. Pretarsus with posterior seta about twice as wide as anterior seta.

RECORDED DISTRIBUTION: Lee and Kerr counties in Texas south to Veracruz, Mexico. The type locality is Mexico without being further specified.

NEW RECORDS: *Maryland:* Baltimore, July 10, 1940 (H. Howden); College Park, as larvae October 11, 1963 (J. H. Fales). *Pennsylvania:* One specimen with locality not further specified (Horn Collection). *Texas:* Burnett County, June 4, 1953 (D. J. and J. N. Knull); Randall County, July 7, 1950 (D. J. and J. N. Knull).

DIAGNOSIS: Both adult and larval characters associate the species with *N. varicolor* and *N. perplexa*. Characters grouping these three species are discussed under Relationships. Adults may be separated from *N. perplexa* by the 11-segmented rather than 10-segmented antenna. Adults are sometimes difficult to separate from *N. varicolor*, although usually *N. aequalis* lacks a clearly defined light maculate spot on the elytron, having only a suffused reddish spot at about the basal third, in contrast to the more or less sharply defined, yellowish tan maculae of *N. varicolor*. Occasional specimens of *N. aequalis* have a completely black or brown elytral integument. Some specimens of *N. varicolor* have a yellowish brown macula that occupies most of the elytron, making them appear quite similar to *N. aequalis*. However, the elytra of these specimens have definitely dark margins and a sutural line. Adults may also be distinguished by the differences in the form of the prosternum described in the key, but the prosternum is often difficult to observe without relaxing the specimen and moving the antennae and legs out of the way.

In contrast to the adults, the larvae of the two species are marked by a number of obvious differences. The maxillary palp of *N. aequalis* has but two setae on the third segment in contrast to the nine or more of *N. varicolor*. The spiracular sclerite of *N. aequalis* appears detached from the tergum, since the tergum is unsclerotized in front of the rim surrounding the spiracular sclerite. Conversely,

the spiracular sclerite of *N. varicolor* appears to be completely imbedded within the lateroposterior corner of the tergum. The setae of the acrotergites of *N. aequalis* consist of both broad, ovate-lanceolate hairs and very long and narrow, almost simple hairs. The setae of the acrotergites of *N. varicolor* are all linear-lanceolate to ovate-lanceolate, with three or more ribs present between the margins. An interesting although perhaps not invariable difference between the species is found in the shape of some of the dorsal setae of *N. aequalis*. The ovate hairs of this species, instead of tapering to a single acute point, frequently terminate in two acute apices (Fig. 23).

ECOLOGY: Almost nothing is known of the ecology of this species. Specimens have been intercepted at the Brownsville, Texas, port of entry on tomatoes and on orchid flowers, but these are no doubt accidental associations. A single specimen was found at Brownsville in milled wheat flour from Mexico. The species has apparently become established in Maryland, where it is probably able to survive in heated buildings.

***Attagenus rufipennis* LeConte**

Attagenus rufipennis LeConte, 1859, p. 71.—Casey, 1900, p. 147.

Attagenus nigripes Casey, 1916 (*non nigripes* Fabricius, 1792), p. 184 (New synonymy).

Attagenus atrolucens Casey, 1916, p. 183 (New synonymy).

ADULT MALES: Integument of head and pronotum brownish black to black; elytra reddish, reddish brown, or black and if reddish or reddish brown usually but not invariably with blackish base and diffused blackish sutural line; ventral surfaces dark reddish brown to black; legs and flagellar shaft of antennae usually somewhat lighter than ventral surfaces; antennal club brownish black to black. Pubescence of head and dorsal surfaces subrecumbent, entirely black, or black with oblique subbasal band of silver or golden-yellow hairs, or black with silver or golden-yellow hairs scattered among black hairs on lateral margins of pronotum and on posterior four-fifths of elytra. Eye emarginate over base of antenna. Antenna 11-segmented; ratio of combined length of first two segments of club to length of terminal segment varying from 1:3.7 to 1:4.8; ratio of length of terminal segment to length of pronotum and elytra combined varying from 1:6.5 to 1:7.9. Channel below eye for reception of flagellar shaft of antenna deeply concave with anterior margin forming carina; margin of carina visible from front

of head; carina projecting knife-like beneath head and curved behind base of maxilla to meet gular suture. Pronotum with lateral margin continued around anterolateral angle; basal lobe gradually rounding or truncate but not produced abruptly posteriad. Punctures of disc about three times diameter of facet of eye and separated by one to one-half times diameter of single puncture; punctures toward sides becoming larger and contiguous. Setae on basal lobe and latero-posterior angles of pronotum subequal in length to setae of disc. Elytron with hairs of disc about as long as combined length of third and fourth segments of antenna. Hypomeron a little inflated or flat on anterior half, occasionally slightly concave on posterior half. Posternum with posterior margin of lateral lobe slightly reflected against lateral half of procoxa; reflected part less than one-third as long as length of horizontal part of lobe and forming angle of 45° or less with horizontal part; prosternal process slightly wider at apex than between coxae; thread-like carina present on process but not extending onto disc of prosternum; thread-like transverse carina separating anterior declivity of prosternum from disc; no denticle present at middle of anterior margin of disc. Epipleuron terminating gradually behind middle of first sternum. Ventral plate of hind coxa forming distinct tooth lateral to insertion of trochanter; plate terminating at posteromedial angle of metepisternum and not meeting metepimeron behind metepisternum. Protibia not carinate on dorsal margin. Mesofemur with anteroventral and posteroventral margins of crural cavity about equally produced and on same plane. Length (of pronotum and elytra combined): 3.0 mm. to 4.1 mm.

ADULT FEMALES: Antennal club with terminal segment subequal to one and two-fifths as long as combined length of two preceding segments; tenth segment equal in length to ninth segment. Length (of pronotum and elytra combined): 3.5 mm. to 4.9 mm.

MATURE LARVAE: Dorsal integument brown. Setae of head golden-brown; setae of nota and terga black; setae of venter of thorax and legs golden-brown; setae of abdominal sterna black to brownish black.

Head: Antenna with terminal seta subequal in length to length of terminal segment; no setae present on second segment. Epipharynx with distal series of two sensory pits, each with diameter about half diameter of sensory pit of middle series. Maxillary palp with two setae on penultimate segment. Labium with four to five narrowly ensiform setae on dorsal (inner) side of each lobe of ligula; setae becoming narrower laterad; first segment of labial palp without seta.

Body setae: Margins and ribs denticulate (Fig. 18). Acrotergite of first abdominal segment with linear and linear-lanceolate setae; widest setae with three ribs between margins. Disc of tergite with intermingled linear and lanceolate setae; widest lanceolate setae usually with four but sometimes five ribs between margins. Sockets of three medial submarginal erect setae with two adjacent sensory pits, one on either side; socket of most lateral erect seta often with one, occasionally two, adjacent sensory pits. First abdominal sternum without longer setae along midline. Sternum of eighth abdominal segment with setae all linear; widest with three, occasionally four, ribs between margins; setae becoming smaller on anterior area of sternum without row of stouter, longer setae near anterior margin.

Spiracle and associated structures: Anterior abdominal segments with spiracle not closed behind by tergum; anterior margin of spiracle rounding; spiracle adjacent to spiracular sclerite (Fig. 12). Spiracular sclerite oval, not enclosed by tergum; four setae ordinarily inserted on sclerite. Tergum forming sclerotized ridge overlying anterior margin of sclerite but tergum not sclerotized in front of ridge, so that sclerite and ridge appear to project peninsula-like beyond lateral margin of tergum.

Abdomen: Eighth abdominal tergum with antecostal suture. Ninth abdominal tergum about two-sevenths as long as tergite of eighth abdominal segment. Two small sclerites present in sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg about half as wide as long; ventral margin about three-eighths as long as length of segment. Tibia with spines arranged as illustrated (Fig. 26). Base of pretarsus with lateral seta twice as wide as medial seta; medial seta extending to about middle of claw.

TYPE LOCALITY: Fort Tejon, California (Lebec, Kern County). The type locality for *A. nigripes* is Milpitas, Santa Clara County, California. The type locality for *A. atrolucens* is Indiana. The type specimen of *A. atrolucens* was from the Levette Collection, which contained many erroneously labeled specimens. I can find no differences between the type specimen of *A. atrolucens* and many individual specimens from California. Since the species has not subsequently been collected in the Midwest, it must be concluded that the locality is in error.

NEW RECORDS: *Arizona:* Cochise County: Cave Creek, Chiricahua Mts., as larva January 5, 1963 (Vincent Roth). *Cocconino County:* Basin Camp, Bar 77 Ranch, 20 miles west of Cameron,

as larvae September 27, 1964 (R. S. Beal); Williams (Barber and Schwarz). Gila County: Globe, April 2, 8, 10, 23, 1933, April 7, 1948 (F. H. Parker); base of Pinal Mt. (D. K. Duncan). Maricopa County: Canyon Lake, upriver, March 31, 1959 (Ivan Jennings); Wickenburg, March 5, 1958 (G. G. Gose). Navajo County: Linden, as larvae August 27, 1957 and August 20, 1962 (R. S. Beal). Yavapai County: Cottonwood, as larvae March 30, 1963 (R. S. Beal). *California*: Alameda County: Hills back of Oakland, April 12, 1908 (Van Dyke Collection). Butte County: Oroville, March 7, 1928 (H. H. Keifer). Calaveras County: Murphys, 2,500 ft. elev., May 14, 1937 (F. E. Blaisdell). Colusa County: Arbuckle, March 30, 1962, April 2, 6, 9, 1962 (P. M. Marsh). Contra Costa County: Berkeley, January 27, 1947 (A. J. Walz); Berkeley, February 27, 1932 (R. P. Allen); Danville, March 23, 1952 (F. X. Williams); Orinda, March 15, 1955 (R. H. Goodwin); Walnut Creek, April 13, 1932 (F. E. Blaisdell); Vine Hill, November 25, 1910 (F. E. Blaisdell). El Dorado County: Fallen Leaf, 6,500 ft. elev., July 3, 1935 (F. E. Blaisdell); Placerville, February 23, 1916 (E. T. Armstrong); Pyramid Ranger Station, July 12, 1948 (P. D. Hurd). Fresno County: Fresno, March 9, 1936 (H. C. Donohoe); Huckleberry Meadow, 6,500 ft. elev., May 10, 1910 (Hopping). Humboldt County: Greenpoint, June 14, 1916 (F. E. Blaisdell). Inyo County: Argus Mountains, April, 1891 (A. Koebele); Independence, April 30 and May 8, 11, 1918 (L. L. Muchmore); Gray's Camp, Independence, May 3, 1919 (L. L. Muchmore); Lone Pine, May 23, 1930 (R. Hopping); Westgard Pass, June 18, 1955 (M. E. Irwin). Lake County: Anderson Springs, May 27, 1951 (W. R. Bauer); Kelseyville, May 15, 1922 (E. P. Van Duzee). Los Angeles County: Crystal Lake, June 29, 1950 (A. T. McClay); Lancaster, April 7, 1927 (L. L. Muchmore); Los Angeles (Coquillett); Mount Wilson, April 30, 1916 (J. O. Martin collection); Pasadena (A. Fenyès); Tujunga, May 20, 1944 (L. R. Gillogly); Whittier, March 26, 1916, and March 26, 1919 (L. L. Muchmore). Marin County: Mill Valley, March 25, 1957, April 5, 1959, April 6, 1954, May 4, 1959, May 13, 1956, May 28, 1951, June 5, 1949 (H. B. Leech); Novato, September 22, 1959 (T. R. Haig). Mariposa County: Yosemite National Park (probably Yosemite Valley), May 16, 20, 1934 (O. Bryant); same locality, May 22, 1908 (E. T. Cresson, Jr.); same locality, May 31, 1952 (R. Schuster); same locality, June 7, 9, 1930 (F. E. Blaisdell). Mendocino County: locality not further specified, October 20, 1918 (E. R. Leach). Modoc County:

Warner Mountains, July 10, 1919 (R. Hopping collection). Monterey County: Carmel, November 8, 1911 (L. S. Slevin collection); Paraiso Springs, April 24, 1914 (L. S. Slevin collection). Nevada County: Truckee, June 17, 1927 (E. P. Van Duzee). Plumas County: Chester, June 25, 1951 (D. J. and J. N. Knull); Meadow Valley, 4–5,000 ft. elev., June 4, 1924 (E. C. Van Dyke); Onion Valley, July 6, 1952 (E. I. Schlinger); Sunnyside near Seneca, June 1, 1923 (V. S. Barber). Riverside County: Banning, April 6, 1933 (R. Hopping); 4 miles west of Forest Home, as larva September 16, 1951 (Ray Ryckman); Hemet, March 30, 1937 (L. D. Christenson); 7 miles north of Idyllwild, San Jacinto Mountains, 5,500 ft. elev., May 8, 1954 (G. H. Nelson); Keen Camp, June 6–12, 1917 (E. P. Van Duzee). Sacramento County: Folsom, May 7, 1941 (A. T. McClay). San Benito County: Pinnacles National Monument, April 24, 1948 (W. W. Middlekauff); Pinnacles National Monument, April 28, 1914 (L. S. Slevin). San Bernardino County: Camp Baldy (Mt. Baldy), June 26, 1950 (M. J. Stebbins); 20 miles northeast of Redlands, 9,000 ft. elev., June 26, 1954 (G. H. Nelson); Victorville, May 2, 1953 (G. A. Marsh and R. O. Schuster). San Diego County: San Diego, February (F. E. Blaisdell); Poway (F. E. Blaisdell). San Francisco County: San Francisco, April 24, 1959 (MacNeill). San Luis Obispo County: Paso Robles, as larvae August 2, 1960 (R. S. Beal). Santa Barbara County: San Marcos Pass northwest of Santa Barbara, as larvae August 1, 1960 (R. S. Beal). Santa Clara County: Pacheco Pass, April 14, 1949, and as larvae August 2, 1960 (R. S. Beal); San José, April 29, 1928 (L. S. Slevin). Santa Cruz County: Santa Cruz Mountains (Koebele collection). Sonoma County: Petaluma, April 2, 1961 (G. M. Trenam); Santa Rosa (Lois B. Stiles). Stanislaus County: Newman, March 9, 1955 (C. G. Moore). Tehama County: Red Bluff, May 1, 1922 (V. S. Brown). Tulare County: Kaweah (R. Hopping); Lodgepole Camp, Sequoia National Park, June 24, 1945 (A. T. McClay); Marble Fork Bridge, Sequoia National Park, June 11, 1929 (Van Dyke); Wolverton, Sequoia National Park, June 25, 1929 (Van Dyke). Ventura County: Ozena Station (Cuyama River at State Route 33), as larvae April 13, 1963 (R. S. Beal). Yolo County: Davis, March 15, 1950 (A. T. McClay); same locality, April 22, 1947 (Brad Stevens); Davis, May 2, 1949 (E. I. Schlinger); Davis, June 7, 1949 (R. C. Bechtel); Putah Canyon, March 26, 1960 (M. E. Irwin); Rumsey, March 31, 1962 (C. G. Moore); Winters, March 30, 1962 (P. M. Marsh). Yuba County:

10 miles south of Marysville, April 19, 1956 (W. W. Middlekauff). *New Mexico*: Hidalgo County: Granite Pass, April 6, 1965 (F. D. Parker). *Oregon*: Jackson County: Green Spring Pass, June 15, 1938 (M. H. Hatch); Griffin Creek, June 6, 1957 (C. Fitch); Medford, as larvae January 12, 1947 (A. T. McClay); Medford, February 9, 1946 (A. T. McClay); Medford, March 1, 1936 (Lawrence); Medford, May 2, 1941, May 2, 1945, May 6, 1945 (C. Fitch); Medford, as larvae October 1, 1946 (A. T. McClay); Talent, March 15, 1932, May 13, 1932 (L. G. Gentner). *Josephine County*: Grants Pass, April 12, 1934 (Frank M. Beer). *Wasco County*: Bear Springs (nine miles west of Pine Grove), July 20, 1940 (K. M. and D. M. Fender); Bear Springs Ranger Station, September 6, 1952 (P. W. Orr); Maupin, June 6, 1937 (K. M. Fender). *Yamhill County*: Dayton, April 24, 1945 (K. M. Fender). *Utah*: Washington County: May 21, 1951 (G. F. Knowlton). *Washington*: Kittitas County: Vantage, May 13, 1956 (H. M. Hatch). *Baja California*: Tecate, March 12, 1957 (Burciaga and Valdez).

A specimen collected at San Antonio, Texas, by H. Soltau is deposited at the United States National Museum. This locality appears to be outside the natural range of the species. The species was probably introduced into the area by commerce, and there is at present no evidence that it has become established there.

DIAGNOSIS: In size and shape and often in dorsal coloration adults of this species resemble *A. megatoma*. Males further resemble *A. megatoma* in the general form of the antennal club, in which the terminal segment is much longer than the first two segments combined. However, the fact that the hind coxa and the metepimeron do not join behind the metepisternum distinguishes this species from *A. megatoma* and all other members of Group I. Adults are separated from species of other groups by the form of the male antennal club and by one or several of the following characters: the antenna is 11-segmented; a small auricle-like lobe is present on the hypomeron behind the base of the procoxa; there is no knife-like carina along the dorsal margin of the anterior tibia; although there may or may not be a subbasal elytral band of light pubescence, there are no distinct submedian or subapical spots, lines, or bands of light pubescence on the elytra.

Differences between the larvae of this species and those of some other similar species are listed under Relationships, Group V.

INFRA-SPECIFIC FORMS: This is a highly polytypic species that

cannot conveniently be divided into a few manageable subspecies. A consistent treatment would require that either the subspecies be ignored or that a considerable number of subspecies be designated. If only the color of the elytra were to be considered, the species could easily be separated into the black northwestern form that Casey (1900) named *A. nigripes*, the nominate southern California form with red elytra, and an Arizona and New Mexico form with mahogany elytra. However, there is no reason why the presence or absence of a subbasal elytral fascia of light-colored hairs and the presence or absence of light-colored hairs on the pronotum should not be given equal weight in determining subspecific limits, since these characters are also geographically ordered. The difficulty is that they are not geographically concordant with the distribution of color variations in the elytra. Black specimens from Merced County, California, and northward generally lack light-colored hairs on the pronotum and elytra. Southward through central and coastal California the black forms commonly have a short subbasal elytral fascia of silvery hairs. However, around San Diego, California, black forms are again found without light-colored hairs. Forms with red elytra occur in the California desert areas, but are also found on the east side of the coastal ranges as far north as San Benito County and along the coast from Los Angeles south to San Diego. One red specimen has been taken at Berkeley, California, and two red specimens in Wasco County, Oregon. Ordinarily the red California specimens have at least a few silvery hairs forming a subbasal elytral fascia. Intermediates between the red and the black forms are not uncommon. A long series from Ozena Station on the north side of the San Rafael Mountains in Ventura County includes numerous intermediates between the red and the black forms as well as specimens with and without elytral fasciae. So also does a shorter series from Lancaster in Los Angeles County. No collections of the species have been made between Victorville, California, and Wickenburg, Arizona. Nevertheless, the species is probably continuous; the single specimen from Wickenburg is identical to many Mojave Desert specimens. A moderate number of specimens has been taken in the neighborhood of Globe, Arizona, and at Linden in Navajo County, Arizona. These all have mahogany elytra with a broad subbasal elytral fascia of golden-yellow hairs. Another long series collected a relatively short distance north near the eastern end of the Grand Canyon but separated from the southern Navajo County population by an intervening stretch of desert has mahogany elytra but no elytral fasciae.

In view of this somewhat confusing picture, it seems inadvisable to name any of the infraspecific forms until much more extensive collections have been made and until the population dynamics are better understood.

ECOLOGY: Larvae have been taken in nests of the wood rat (*Neotoma*), in webs of the spider *Physocylus tanneri* Chamberlin, and in insect-infested grain trash in a granary. Linsley (1944, 1946) has recorded it in nests of the English sparrow, house finch, black phoebe, barn swallow, and cliff swallow. It is evidently a general scavenger on dried protein materials, as are most other members of the genus. H. B. Leech found adults emerging from stems of dead *Ceanothus thrysiflorus* Eschscholtz, but in all probability they were feeding on the dead remains of other insects in burrows in the stems. The species has been found on one occasion infesting an insect collection. Specimens from Talent, Oregon, are labeled by L. G. Gentner as "breeding in casein."

Probably adults ordinarily fly to flowers, where they feed on nectar and pollen. They have been collected on apple blossoms, lupine, *Ceanothus cordulatus* Kellogg and *Ceanothus divaricatus* Nuttall. Flying to flowers does not appear to be necessary for reproduction for Arizona forms of the species, since I have been able to carry them through several generations without it. On the other hand, although I have been able to rear larvae of the black forms to maturity in the laboratory, the adults have never produced a second generation in the laboratory. It may be that in contrast to the Arizona forms they need to feed on nectar or pollen before being able to mate.

***Novelsis uteana* Casey**

Novelsis uteana Casey, 1900, p. 148.—Beal, 1954, pp. 82–84.

Novelsis byturoides Casey, 1900, p. 148.

ADULTS: Redescribed by Beal (1954).

MATURE LARVAE: Integument of head brownish black; integument of nota and terga light reddish brown with prominent blackish brown macula on side of each notum and smaller, somewhat diffused, blackish brown macula on side of each tergum. Setae of head dark brown; setae of dorsal surfaces white except for dark brown setae on spiracular sclerites, dark brown setae on margins of eighth and ninth terga, and dark brown terminal setae; setae of ventral surfaces black; setae of legs light golden-brown; stout setae of legs brownish black.

Head: Antenna with terminal seta about one-fourth longer than length of terminal segment; second segment without setae. Epipharynx with usual proximal series of about 16 sensory pits and middle series of six sensory pits but without usual distal sensory pits. Maxillary palp with two setae inserted on third segment. Labium with two ensiform setae only on dorsal (inner) surface of each lobe of ligula; palp with or without two setae on first segment.

Body setae: Long, fine setae of acrotergites smooth; setae of dorsal surfaces denticulate on margins and ribs; setae of ventral surfaces mostly smooth but some setae with extremely finely serrulate margins (visible only under high magnification). Acrotergites with setae of two types: (1) row of ensiform setae with denticulate margins and two or three ribs between margins and inserted close to antecostal suture, (2) number of simple setae nearly as long as half length of tergite and gradually becoming extremely fine (almost beyond resolution except with oil-immersion lens) and inserted anterior to ensiform setae. Tergites with linear to lanceolate setae with one to five ribs between margins but most commonly with four ribs between margins; lateral areas of nota and anterior tergites also with few long simple setae. Sockets of submarginal erect setae with one lateral adjacent sensory pit except that submarginal seta nearest spiracle may have two adjacent sensory pits. Sterna with linear setae only; these with two to three ribs between margins except for slender setae on anterior area of sternum; anterior area of sterna without row of longer, stouter, linear setae; first abdominal sternum with somewhat longer setae at midline.

Spiracle and associated structures: Spiracle close to margin of tergum but closed by tergum and adjacent to spiracular sclerite; anterior margin more or less straight. Spiracular sclerite somewhat rhomboidal, not enclosed by tergum. Tergum forming sclerotized margin along anterior edge of sclerite but area anterior to margin not sclerotized; sclerite appearing to project laterad and somewhat posteriad of tergum.

Abdomen: Eighth abdominal tergum with antecostal suture. Ninth abdominal tergum about two-sevenths as long as tergite of eighth abdominal segment. No sclerites present in sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg about $9/16$ as wide as long; ventral margin about one-half as long as dorsal margin. Tibia with five stout setae in subdorsal row on posterior face. Setae at base of pretarsus ensiform, subequal in length; seta on posterior side a third wider than seta on anterior side.

DISTRIBUTION: Ranging from Independence, Inyo County, California, south throughout Mojave and Borego deserts to northern Baja California, eastward into Clark County, Nevada, Washington County, Utah, all desert areas of Arizona south of the Mogollon Rim, Hidalgo County, New Mexico, and southeast along the Rio Grande River to Brewster County, Texas. The species probably extends well into Mexico, but I have seen no collections of it from Mexico outside Baja California.

DIAGNOSIS: Males of this species have a distinctive color pattern on the elytra. Contrasting with the dark brown hairs of the elytron are white hairs which form a basal patch or short band, a diagonal band extending from the humeral angle to the median suture at about the basal two-fifths, and a number of lines extending from the diagonal band nearly to the apex of the elytron. Some females, particularly those from Pima and Santa Cruz counties in Arizona, resemble the males, but females from other Arizona areas, California, Nevada, and Utah are covered dorsally with white pubescence alone. No other Nearctic Attagenini are likely to be confused with it, except perhaps *A. lobatus*, which is uniformly covered with light golden-brown pubescence. However, *A. lobatus* has an 11-segmented antenna, while *N. uteana* has a 10-segmented antenna. Other distinguishing features of *A. lobatus* are discussed under the diagnosis of that species.

The color of the setae of the larvae distinguishes them at once from known larvae of all other Nearctic species. Those on the head are dark brown, on the dorsum predominantly grayish white, on the ventral surfaces black, and on the legs light golden-brown. The larvae are likewise unique in that the hairs of the acrotergites consist of a row of ensiform setae near the antecostal margin and of numerous, extremely long and fine, simple setae. The former have denticulate margins with two or three ribs between the margins. The simple setae are tapering, the ends becoming exceedingly fine, visible only under the high powers of a compound microscope.

DISCUSSION: Casey treated the light-colored females and the forms marked with light and dark hairs as separate species. In my previous revision of *Novelsis* (1954) I synonymized the forms on the basis of the geographic distribution of museum specimens. Subsequently I have been able to obtain live adults from near Peoria, Arizona. These bred readily in the laboratory, and from them I have been able to rear several generations of the species. Observations on the breeding of the forms confirmed my supposition that

the forms are no more than sexually dimorphic variants of one species.

ECOLOGY: The habitats of the larvae have not yet been discovered. The larvae have been reared to maturity in the laboratory on dried insects, but an effort to rear the species on dried dog food, which is suitable for most dermestids, was a failure. Adults mate and oviposit in the laboratory without the necessity of food or water. Adults are ordinarily collected out-of-doors on flowers and have been taken on mesquite [*Prosopis juliflora* (Swartz) DC.], catclaw (*Acacia greggii* A. Gray), ironwood (*Olneya tesota* A. Gray), French tamarix (*Tamarix gallica* L.), sandpaper-plant (*Petalonyx thurber* A. Gray), heliotrope (*Heliotropum curassavicum* L.), and willow. The species was collected once on a farm near Casa Grande, Arizona, in the course of inspections for the khapra beetle. However, the situation in which it was found was not recorded.

Novelsis horni (Jayne)

Attagenus horni Jayne, 1882, p. 356.—Sharp, 1902, p. 645.

Attagenus byturodes Jayne, 1882, p. 356.

Novelsis horni: Casey, 1900, p. 148.—Rees, 1943, p. 15.—Beal, 1954, pp. 85–86.

ADULTS: Redescribed by Beal (1954).

MATURE LARVAE: Integument of head and dorsal surfaces yellowish brown. Setae of head dark golden-brown, sometimes with black hairs around occiput; setae of dorsal and ventral surfaces of body black; setae of legs golden-brown.

Head: Antenna with terminal seta about one and one-half times as long as length of terminal segment; second antennal segment without setae. Epipharynx with proximal series of about 24 sensory pits and middle series of six sensory pits but without usual distal sensory pits. Maxillary palp with two setae inserted on third segment. Labium with three ensiform setae on dorsal (inner) surface of each lobe of ligula; medial seta wide with lateral setae progressively narrower; palp without seta on first segment.

Body setae: Margins of setae on disc of pronotum smooth; margins of setae of mesonotum, metanotum, and terga minutely serrulate (serrulations visible only under high power of compound microscope); anterior setae on each tergum with coarser serrulations than posterior setae; setae of sterna smooth or extremely minutely serrulate. Acrotergites with small, linear setae with one rib between margins and larger, linear-lanceolate setae with one, two, or rarely

three ribs between margins. Tergites with most setae spindle-shaped but some linear; widest setae usually with two, sometimes three ribs distinctly visible between margins. Sockets of submarginal erect setae with one sensory pit near lateral margin. Sterna with linear setae only; widest setae usually with no more than two ribs distinctly visible between margins but three ribs occasionally visible. First abdominal sternum with setae along midline somewhat longer than other setae of disc. Setae of each sternum becoming smaller toward anterior margin without anterior row of longer, stouter setae.

Spiracle and associated structures: Spiracle opening on margin of tergum, not closed by tergum, and adjacent to spiracular sclerite; anterior margin curved. Spiracular sclerite subrectangular, weakly sclerotized, bearing six or fewer setae, not enclosed by tergum. Tergum forming sclerotized margin along anterior edge of sclerite but area of tergum anterior to margin not sclerotized. Sclerite appearing to project laterad and somewhat posteriad of tergum.

Abdomen: Eighth abdominal tergum with antecostal suture. Ninth abdominal tergum about half as long as tergite of eighth abdominal segment. No sclerites present in sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg about half as wide as long; ventral margin about $5/12$ as long as length of segment. Tibia with six or seven stout setae on posterior face below dorsal margin; setae arranged more or less in two rows. Setae inserted at base of pretarsus subequal in length, not extending beyond basal fourth of claw; posterior seta ensiform, about twice as wide as anterior seta.

DISTRIBUTION: The species is recorded from southern California, southern Arizona, New Mexico, southwestern Texas, Wills Point, Louisiana, Mexico City and Tabasco, Mexico. New records extending the periphery of the known distribution are the following. *Arizona:* Cottonwood, Yavapai County, as larva March 30, 1963 (R. S. Beal); Flagstaff, Coconino County, as larva January 11, 1963 (R. S. Beal). *New Mexico:* Tucumcari, Quay County, May 23, 1957 (R. M. Eads). *Texas:* Clear Fork, Brazos River, Jones County, September 29, 1957 (R. S. Beal). **MEXICO:** Basuchil, 6-7,000 ft. elev. (Mrs. Y. Mexia).

DIAGNOSIS: Adults of this species and *N. andersoni* are readily distinguished from all others in the tribe by the cross-shaped, light yellowish brown marking on the blackish elytra. The longitudinal part of the cross is formed by a narrow line that extends along the suture from the base nearly to the apex. A somewhat broader transverse band intersects this line at the basal third. In *N. horni*

the transverse band is somewhat expanded laterally, often into a short, posteriorly directed spur near the lateral margin. In no case does the spur extend posteriorly beyond the middle of the elytron. In *N. andersoni* the transverse band is also expanded laterally, but there is always a light colored line extending from the humerus along the margin of the elytron to the apical third or beyond. Females of *N. horni* may also be distinguished from those of *N. andersoni* by the 11-segmented antenna. Females of *N. andersoni* have a 10-segmented antenna. Males of both species have an 11-segmented antenna.

Larvae of *N. horni* and *N. andersoni* are apparently indistinguishable from each other. They may be separated from larvae of other Attagenini by the following combination of characters. The color of the setae of the head is dark golden-brown, of the dorsal and ventral surfaces black, and of the legs golden-brown. The setae of the acrotergites are linear and linear-lanceolate, those of the tergites mostly spindle-shaped with two or three ribs visible between the margins. The spiracular sclerite, which is difficult to observe because of the dense, black setae, appears to be separated from the tergite, but is actually inserted within a narrow ring of the tergite that extends peninsula-like from its lateroposterior angle. The two setae inserted on the pretarsus of each leg are unequal, one being twice as wide as the other.

ECOLOGY: The species occurs in a wide variety of habitats and is obviously a general scavenger on dried protein materials. It has been collected in *Sceliphron* mud dauber nests in Arizona (Beal, 1951) and in Texas. I found it in Flagstaff, Arizona, on a dead bat in an attic and in large numbers in Cottonwood, Arizona, in nests of the spider *Physocyclus tanneri* Chamberlin. It was reared from larvae found by John LeCave in an English sparrow nest in Tucson, Arizona. H. G. Hubbard recorded in his dairy (deposited at the United States National Museum) on April 15, 1897, that he took the species at Tucson "in bunch of curled leaves of cottonwood with aphids."

The adults reproduce readily in the laboratory without the necessity of drinking or of flying. However, the adults probably regularly fly out-of-doors to flowers. The species has been taken at Nogales, Arizona, on blossoms of mesquite (*Prosopis juliflora*).

The species can be considered a negligible pest of stored products. K. S. Rohwer collected it in a feed and seed store in Willcox, Arizona. R. M. Eads found it on cotton seed in a warehouse at Tucumcari, New Mexico. Occasional specimens are found in homes.

I reared it through a number of generations on dried dog food and through at least one complete generation on oatmeal.

Novelsis andersoni Beal

Novelsis andersoni Beal, 1954, pp. 86-88.

ADULTS AND LARVAE: Adults were described by Beal (1954). No characters have been found by which the larvae differ from larvae of *N. horni*.

RECORDED DISTRIBUTION: The type locality is forty miles west of Mexicali, Baja California. It has also been recorded twenty miles west of Mexicali and twenty miles south of Palacio, Baja California, at Fort Yuma, Imperial County, California, and at Phoenix, Arizona.

NEW RECORDS: *Arizona:* Maricopa County: Fort McDowell, May 12, 1962 (R. S. Beal); Gillespie Dam, as larva November 13, 1958 (R. S. Beal); Komatke, April 9, 1960 (R. S. Beal); Maricopa, adults, pupa, and larva November 8, 1956 (R. S. Beal); Tempe, April 16, 1959 (E. O. Johnson); same locality, April 24, 1962 (R. K. Weaver). *Yuma County:* Parker, January 22, 1958 (G. H. Spitler); Roll, April 18, 1958 (N. Berry and E. F. Pittman); Yuma, April 13, 1955 (Butler and Tuttle); same data (Butler and Werner); same locality, April 6, 20, 1959 (D. Muse). *California:* Indio (Fall).

DIAGNOSIS: Adults of this species are strikingly similar to those of *N. horni* and were confused with them by earlier authors. Specimens of this species stand in both the LeConte and the Fall collections at the Museum of Comparative Zoology under the name *horni*. Nevertheless, the species are readily distinguished by differences in the pattern of elytral maculation. In *N. horni* there is a subbasal band at the basal third that is expanded laterally, sometimes forming a short lateral line along the margin of the elytron in the basal fourth. Occasionally there is a lateral spur extending a short distance posteriad. In no instance does the spur extend beyond the middle of the elytron. On the other hand, *N. andersoni* has a lateral line on the elytron that extends to the apical third or fourth. The line may be broad or very narrow and interrupted so far as the colors of the integument are involved, but it is always plainly indicated by the pattern of white hairs. The two species are also distinguished by the number of segments in the antennae of the females. *N. horni* females have 11 segments; *N. andersoni* 10 segments.

The diagnosis of the larval stages is given under the diagnosis of *N. horni*.

ECOLOGY: Larvae of this species have been found in a number of different situations, suggesting that it is a general scavenger on dried protein materials, like most other members of the tribe. It was taken at Maricopa, Arizona, in a *Sceliphron* mud dauber nest and at Gillespie Dam, Arizona, in a swallow nest. At Roll, Arizona, a specimen was found on a dead mouse. A specimen deposited at the United States National Museum reportedly came from a Tempe, Arizona, flour mill. The writer has reason to believe that the specimen did not come from the mill itself but from a neighboring warehouse filled with grain sacks heavily infested with *Ephestia* and other insects, where it was likely feeding on their dead remains.

Adults have been swept from mesquite (*Prosopis juliflora*), creosotebush [*Larrea tridentata* (DC.) Coville], and willow.

Novelsis timia Beal

Novelsis timia Beal, 1954, pp. 82, 88.

ADULT FEMALES: Described by Beal (1945). Males were unknown at the time of the description of the species. The following is a description of a male from Highway 74 above Palm Desert, Riverside County, California.

ADULT MALES: Integument of head dark brown; integument of pronotum light brown with lateral carina and narrow posterior border dark brown; elytra light brown; ventral surfaces brown with abdomen dark brown; legs and antenna yellowish tan. Pubescence of head and dorsum subrecumbent, piceous and golden-white; pubescence of ventral surfaces recumbent, white. Eye emarginate over base of antenna. Antenna 11-segmented, in repose extending behind anterior margin of metasternal episternum; flagellar shaft (segments 3–8) little shorter than first segment of club (segment 9); ratios of lengths of first, second, and third segments of club 11:13:21; ratio of length of terminal segment to length of pronotum and elytra combined 1:7.3. Channel below eye for reception of flagellar shaft of antenna shallowly concave; anterior margin of channel forming low carina not visibly projecting from side of head when seen from front (similar to Fig. 2); carina not curved behind base of maxilla but projecting diagonally behind base of maxilla parallel to margin of eye (relation of carina to gular suture not apparent since suture not distinct). Pattern of pubescence of pronotum and elytra as described for female. Pronotum with lateral

carina continued thread-like around anterolateral angle; basal lobe feebly rounding or truncate and not produced abruptly posteriad; disc with intermingled craterform punctures about diameter of facet of eye and simple punctures about half diameter of facet of eye; punctures separated by less than half diameter of larger punctures; punctures toward side becoming slightly larger but not quite contiguous; setae on basal lobe and lateroposterior angles about twice length of setae of disc. Elytron with hairs of disc about one and one-half times as long as third segment of antenna. Hypomeron slightly inflated. Posternum with posterior margin of lateral lobe scarcely reflected against procoxa; prosternal process slightly expanded at apex, not extending posteriad as far as apex of procoxa in repose; disc of prosternum without longitudinal carina, without distinct lateral carina before anterior margin, and without median anterior denticle. Epipleuron terminating gradually behind first abdominal sternum. Ventral plate of hind coxa not forming tooth lateral to insertion of trochanter; plate extending behind metepisternum but not quite attaining metepimeron. Protibia not carinate on dorsal margin. Mesofemur with crural cavity in nearly horizontal plane; anteroventral carina extending from apex to about basal third; posteroventral carina indistinct. Metatibia with stout spines and setae along shaft not longer than apical spines. Length (of pronotum and elytra combined): 2.5 mm.

RECORDED DISTRIBUTION: The species has been known only from its type locality, Potholes, Imperial County, California, and one other locality, Palm Springs, California.

NEW RECORDS: *Arizona:* Junction of the North and South Forks of the Santa Maria River, Yavapai County, as larva November 20, 1956 (R. S. Beal). *California:* Highway 74, 3,000 ft. elev., above Palm Desert, Riverside County, June 21, 1961 (G. H. Nelson); Painted Canyon (near Indio), April 18, 1926 (Low); Palm Springs, May 20, 1916 (H. C. Fall Collection).

DIAGNOSIS: The three transverse bands of light pubescence on the elytra distinguish this from most of the other species considered here. *N. perplexus*, *N. varicolor*, and *N. aequalis* also have three or more bands of light colored pubescence on the elytra, but in these species the pubescence is long, giving the specimens a shaggy appearance, and the pubescence is tricolorous. In *N. timia* the dorsal hairs are quite short and are bicolorous. *N. picta* might be confused with *N. timia*; the two species mutually resemble each other more than they do any other species. However, *N. picta* has a 10-

segmented antenna, *N. timia* an 11-segmented antenna. *N. picta* also has a number of long hairs on the hind tibia that are two or three times as long as the apical spines of the tibia. The tibial hairs of *N. timia* are at most no more than subequal to the tibial spines.

ECOLOGY: Almost nothing is known of the ecology of the species. Adults have been taken on catclaw (*Acacia greggii*). One larva was found in a sheltered bird's nest in a recess in a cliff on the Santa Maria River in central-western Arizona. The nest was not positively identified, but possibly was a phoebe nest.

UNNAMED FORMS NEAR *N. timia*: Three Arizona specimens that may represent a geographic variant of *N. timia* or possibly a new species near *N. timia* have been collected by the author. They closely resemble specimens of *N. timia* except that the integument is darker brown and the antennae of two of the specimens are 10-segmented. Data for the specimens are as follows: McDowell Mountains, Maricopa County, May 6, 1962, on flowers of *Acacia* (11-segmented antenna; female); same locality, May 19, 1961, at light (10-segmented antenna; male); Komatke, Maricopa County, August 25, 1966, at light (10-segmented antenna; male).

***Novelsis picta* Casey**

Novelsis picta Casey, 1900, p. 184.—Beal, 1954, pp. 81–82, 89.

ADULT MALES: Redescribed by Beal (1954).

ADULT FEMALES: Previously undescribed; differing from males in the following observed characteristics: Antenna in repose extending to middle of lateral margin of pronotum; ratio of length of first, second, and terminal segments of club 11:10:20. Length of pronotum and elytra combined): 3.6 mm. to 3.8 mm.

RECORDED DISTRIBUTION: The type locality is given as Riverside, Arizona. The locality was later named Kelvin (Barnes, 1960) and is located in Pinal County seven miles northwest of Kearny. In addition the species has been recorded from the following Arizona localities: west of Tucson, San Luis (Yuma County), and Hot Springs (Castle Hot Springs, Maricopa County?). It has also been recorded from four miles east of Yermo, San Bernardino County, California.

NEW RECORDS: *Arizona:* Globe (D. K. Duncan); Sabino Canyon, Santa Catalina Mountains, July 12, 1935 (E. D. Ball); same locality, June 29, 1955 (G. D. Butler and F. W. Werner); Santa Rita Range Reserve, Pima County, May 23, 1957 (G. D. Butler and F. W. Werner); Tucson, June 25, 1937 (O. Bryant).

California: Cathedral City, Riverside County, June 20, 29, August 24, 28, 1950 (L. W. Isaak); 15 miles east of Calexico, Imperial County, June 5, 1961 (G. H. Nelson and H. F. Howden); Trona, San Bernardino County, June 13, 1961 (G. H. Nelson).

DIAGNOSIS: Adults of the species are easily distinguished from most other Nearctic Attagenini by the three bands of light pubescence on the elytron. There is a broad subbasal band, a narrow submedian band, and a narrow subapical band. Sometimes the subbasal band occupies the entire basal area of the elytron except for a patch of darker pubescence that forms a subbasal "eye." The subapical band may or may not extend to the elytral apex or there may be a separate apical patch of light pubescence. *N. aequalis*, *N. varicolor*, and *N. perplexus* also have three or more bands of light-colored pubescence on the elytra. However, in these species the darker colored hairs of the elytra are blackish rather than a golden-brown, as they are in *N. picta*. Only *N. timia* is likely to be confused with *N. picta*, but *N. timia* has an 11-segmented rather than 10-segmented antenna. *N. picta* is unique among Nearctic Attagenini in having long, erect or suberect setae along the posterior face of the shaft of each tibia in addition to the usual appressed hairs and short, stout, erect, spine-like setae. On the hind tibia these hairs are up to a fourth longer than the longest apical spines of the tibia. The species is also remarkable for the length of the segments of the antennal club of the male. The antenna in repose may extend beyond the hind margin of the metepimeron.

ECOLOGY: No information on the species is available other than that adults have been swept from mesquite (*Prosopis juliflora*) and *Condalia* sp. (Rhamnaceae). They have also been taken at light. The larval stages remain unknown.

SPECIES DESCRIBED BUT UNRECOGNIZED

There is no way of knowing the identity of the following species, since the types have been lost and the original descriptions are not definitive:

Attagenus cylindricornis Say, 1825, p. 185.

Attagenus cylindricollis Melsheimer, 1853, p. 48.

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